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The 2001 Bryophyte Expedition on the Santa Margarita Ecological Reserve, in the Peninsular Ranges of Southern California
Steven L. Jessup, Ken Kellman, John Spence, James R. Shevock, Lloyd R. Stark, William Doyle 1

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The 2001 Bryophyte Expedition on the Santa Margarita Ecological Reserve, in the Peninsular Ranges of Southern California

Steven L. Jessup[1], Ken Kellman[2], John Spence[3], James R. Shevock[4], Lloyd R. Stark[5], William Doyle[6]

Abstract. *Bryophytes collected on the Santa Margarita Ecological Reserve in the coastal peninsular Santa Margarita Mountains of Southern California are documented. Collections were made during the sixth annual Spring Outing, Botanical Excursion, Foray, Retreat, and Escape to the Environment (SO BE FREE), and include 63 moss taxa in 32 genera and 12 families, 12 liverwort taxa in 7 genera and 6 families, and 2 hornwort taxa. Collections included plants representing 3 new species in* Bryum. *New localities were discovered for the rare and little known bryophytes* Bryum pyriferum, Schizymenium shevockii, Tortula californica, *and* Sphaeropheros drewei.

Introduction. The Santa Margarita Ecological Reserve is centered around Temecula Canyon, at about 33°27'N, 117°11'W, on the San Diego County - Riverside County line (fig. 1). The reserve, one of four San Diego State University field stations, occupies 4344 acres, ranging in elevation from 150 to 700 m, situated approximately 30 km from the Pacific Coast in the Santa Margarita Mountains at the southern extreme of the Santa Ana Range. The vegetation is a mosaic of coastal sage scrub, oak woodlands, and chaparral. The steep and rolling terrain is punctuated by cliffs and riparian corridors. Annual precipitation averages about 400 mm with most of the precipitation occurring during the relatively cool winters. Mean annual temperature is approximately 16.4°C.

The Sixth Annual Meeting of Spring Outing, Botanical Excursion, Foray, Retreat, and Escape to the Environment (SO BE FREE) convened at the Santa Margarita Ecological Reserve Field Station 24-27 March 2001. During the meeting the attentions of the more than thirty botanists attending were focused on compiling a list of taxa in the bryophyte flora of the reserve. This report summarizes the findings of that effort with a list of taxa comprising approximately 12% of the known bryophyte flora of California, including 3 taxa new to science.

On the first day of the foray we explored along the Santa Margarita River in Temecula Canyon. This riparian area is subject to periodic flooding and scouring. Proximity of the city of Temecula, with its urban runoff, and other upstream uses contributing to eutrophication such as agriculture, adversely affects the aquatic bryophyte component of the river corridor. Pools and river margins exhibited a lush development of fresh-water

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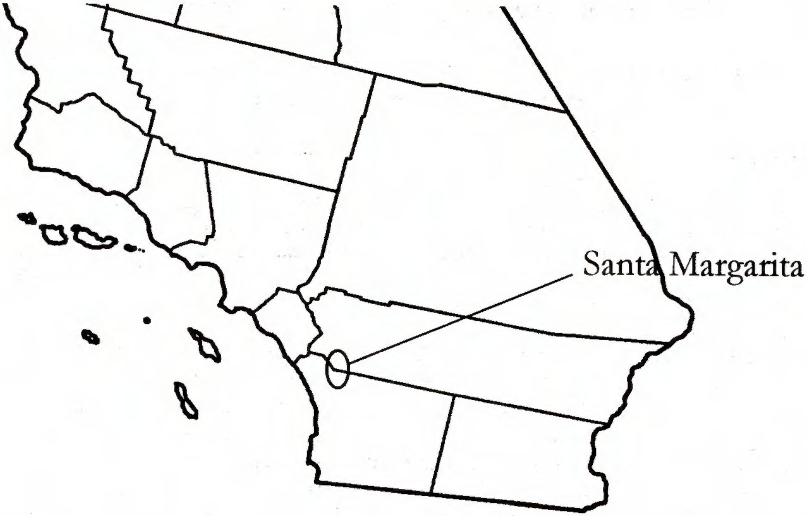

Fig. 1. 2001 SO BE FREE Expedition Site. Santa Margarita Ecological Reserve

algae, probably due to nitrogen and phosphorus inputs, apparently at the expense of bryophytes since very few taxa were found in the river. Sandy soils comprise the flood zone while the canyon walls are a mixture of granitic and metasedimentary rocks within a dense woodland and chaparral. Excursions on the second day focused on the upland portions of the reserve, primarily in the California live oak woodlands and associated openings in chamise chaparral above the river canyon.

The bryophyte flora of the southwestern U.S. and northwestern Mexico has been previously documented in a series of papers (Bowers, Delgadillo & Sharp, 1976; Harthill, Long & Mishler, 1979; Stark & Whittemore, 1992) and in a recent flora (Sharp, Crum & Eckel, 1994). That considerable bryophyte diversity remains to be discovered in this region is clearly demonstrated by the series of novelties and rarities discussed below. Collection numbers in the following list are indicated with a three-letter prefix: DYL=Doyle, JSS=Jessup, KLL=Kellman, SHV=Shevock, SPC=Spence. Shevock and Kellman collections are housed at CAS. Doyle and Spence collections are in their personal collections. Jessup collections are housed at SOC. Nomenclature generally follows that of Anderson, Crum and Buck (1990), and Zander (1993) for the Pottiaceae. Family designations follow Buck & Goffinet (2000).

Hornworts

ANTHOCEROTACEAE

Anthoceros

fusiformis Aust. [DYL 9898, 9909]

Phaeoceros

pearsonii (Howe) Prosk. [DYL 9911; 13-62]

Liverworts

AYTONIACEAE

- ***Aasterella***
    - ***californica*** (Hampe) Underw. [DYL 9902; JSS 13-08]
    - ***palmeri*** (Aust.) Underw. [DYL 9901; JSS 13-03]
- ***Cryptomitrium***
    - ***tenerum*** (Hook.) Aust. [DYL 9901; JSS 13-33]

CEPHALOZIELLACEAE

- ***Cephaloziella***
    - ***byssacea*** (Roth) Warnst. [DYL 9903, 9907; JSS 13-15, 13-30, 13-52]

FOSSOMBRONIACEAE

- ***Fossombronia***
    - ***longiseta*** Aust. [DYL 9899; JSS 13-04; SHV 20516]

RICCIACEAE

- ***Riccia***
    - ***campbelliana*** Howe [DYL 9895; JSS 13-11]
    - ***nigrella*** DC [DYL 9896; JSS 13-05]
    - ***sorocarpa*** Bisch. [DYL 9894; JSS 13-17]
    - ***trichocarpa*** Howe [DYL 9897; JSS 13-01]

SPHAEROCARPACEAE

- ***Sphaerocarpos***
    - ***drewei*** Wigglesw. [JSS 13-68]
    - ***texanus*** Aust. [DYL 9898, 9909]

TARGIONIACEAE

- ***Targionia***
    - ***hypophylla*** L. [DYL 9900; JSS 13-02, 13-16, 13-41]

Mosses

BARTRAMIACEAE

- ***Anacolia***
    - ***menziesii*** (Turn.)Par. [SHV 20485]
- ***Bartramia***
    - ***stricta*** Brid. [JSS 13-54; SHV 20534]

BRACHYTHECIACEAE

- ***Eurynchium***
    - ***hians*** (Hedw.) Sande-Lac. [SPC 5430]
- ***Homalothecium***
    - ***arenarium*** (Lesq.) Lawt. [SHV 20486]
- ***Scleropodium***
    - ***cespitans*** (C. Müll.) Koch [KLL 1380]
    - ***colpophyllum*** (Sull.) Grout [JSS 13-60; SHV 20450, 20509]
    - ***touretii*** (Brid.) L.Koch [JSS 13-32]

BRYACEAE

- ***Anomobryum***
    - ***argenteum*** (Hedw.) Spence [SHV 20489; SPC 5434]
- ***Bryum***
    - ***bicolor*** Dickson [SHV 20491, 20513; SPC 5432; KLL 1366]
    - ***caespiticium*** Hedw. [KLL 1379; SPC 5439]
    - ***dichotomum*** Hedw. [KLL 1366]

gemmilucens Wilcz. & Dem. [JSS 13-37, 13-42; KLL 1388; SPC 5433]
gemmiparum De Not. [KLL 1382, 1383]
pseudotriquetrum (Hedw.) Gaertn., Meyer & Scherb. [SHV 20515]
pyriferum Crund. & Whiteh. [SHV 20496; SPC 5435]
species nov. C [KLL 1374a]
species nov. D [SPC 5429]

Rosulabryum
capillare (Hedw.) Spence [SPC 5437]

DITRICHACEAE
Ceratodon
purpureus (Hedw.) Brid. [KLL 1372]
Pleuridium
acuminatum Lindb. [JSS 13-06; KLL 1367; SHV 20488]

FISSIDENTACEAE
Fissidens
sublimbatus Grout [JSS 13-18, 13-27; KLL 1364; SHV 20483, 20499]

FUNARIACEAE
Funaria
hygrometrica Hedw. [JSS 13-09; SHV 20493]
muhlenbergii Turn. [KLL 1384, 1387]

GRIMMIACEAE
Grimmia
laevigata (Brid.) Brid. [JSS 13-38, 13-58; KLL 1397; SHV 20507]
lisae DeNot. [KLL 1398]
montana B.S.G. [KLL 1377]
pulvinata (Hedw.) Sm. ex Sm & Sowerb. [JSS 13-36; SHV 20487]
reflexidens C. Müll. [JSS 13-43]
trichophylla Grev. [SHV 20484]
ungeri Jur. [KLL 1373]
Schistidium
cinclinodonteum (C. Müll. in Röll.) Bremer [JSS 13-28]

LESKEACEAE
Claopodium
whippleanum (Sull.) Ren. & Chard. [JSS 13-59]

MNIACEAE
Schizymenium
shevockii J. Shaw [SHV 20506]

ORTHOTRICHACEAE
Orthotrichum
tenellum Bruch ex Brid. [JSS 13-61, 13-64, 13-65; KLL 1389]

POTTIACEAE
Aloina
aloides (Schultz) Kindb. [SHV 20504]
bifrons (De Not.) Delg. [JSS 13-81; KLL 1393]
rigida (Hedw.) Limpr. [KLL 1379B]

Barbula
  convoluta Hedw. [KLL 1367a]

Crossidium
  seriatum Crum & Steere [KLL 1395, 1400]

Didymodon
  australasiae (Hook. & Grev.) Zand. [JSS 13-56; KLL 1399]
  brachyphyllus (Sull.) Zand. [JSS 13-31; KLL 1370]
  nicholsonii Culm. [KLL 1375]
  tophaceus (Brid.) Lisa [SHV 20494]
  vinealis (Brid.) Zand. [JSS 13-14; KLL 1368; SHV 20501, 20503]

Eucladium
  verticillatum (Brid.) B.S.G [JSS 13-55; KLL 1378; SHV 20510]

Gymnostomum
  aeruginosum Sm. [JSS 010345; SHV 20505]

Microbryum
  davallianum (Sm.) Zand. [JSS 13-67; SHV 20512]
  starkeanum (Hedw.) Zander [KLL 1390]

Pseudocrossidium
  replicatum (Tayl.) Zand. [JSS 13-29]

Stegonia
  hyalinotrichum (Card. & Thér.) Zand. [KLL 1394]

Syntrichia
  bolanderi (Lesq. & James) Zand. [JSS 13-24]
  princeps (DeNot.) Mitt. [JSS 13-25; SHV 20495, 20497]
  ruralis (Hedw.) Web. & Mohr [JSS 13-74]

Timmiella
  anomala (BSG) Limpr. [JSS 13-10, 13-46; SHV 20490, 20492, 20498, 20508]

Tortula
  antherodes Zand. [KLL 1401]
  atrovirens (Sm.) Lindb. [JSS 13-13; KLL 1374]
  brevipes (Lesq.) Broth. [JSS 13-48, 13-76; KLL 1365, 1385, 1396 1402; SHV 20502, 20511]
  californica Bartr. [KLL 1392]
  inermis (Brid.) Mont. [SHV 20514]
  obtusifolia (Schwaegr.) Math. [KLL 1376]
  protobryoides Zand. [KLL 1379a]

Weissia
  andrewsii Bartr. [JSS 13-63]

RHABDOWEISIACEAE

Dichodontium
  pellucidum (Hedw.) Schimp. [KLL 1369, 1386]

Discussion. Sixty-three species of mosses in thirty-two genera and twelve families were collected and identified from the Santa Margarita Ecological Reserve. Twelve liverwort taxa were found, representing seven genera and six families, and two hornwort taxa were found. These collections represent over 10% of the moss flora known from California.

The liverworts, though not as diverse in the region, are represented by several distinct taxa; complex thalloid taxa are especially well represented. Eleven mosses, representing about 17% of the total number found, are here documented for the first time in Southern California (*Bryum pyriferum, Eurynchium hians, Scleropodium colpophyllum, Pleuridium acuminatum, Fissidens sublimbatus, Grimmia lisae, Didymodon australasiae, Pseudocrossidium replicatum, Schizymenium shevockii, Tortula obtusifolia*, and *Weissia andrewsii*). Another three species in *Bryum* (sens. lat.) are new to science. Two liverwort species are rare, narrowly endemic taxa (*Sphaerocarpus drewei, Geothallus tuberosus*), and two species of mosses are considered rare in the area but have wider geographic distributions (*Stegonia hyalinotrichum, Homalothecium arenarium*).

The bryophyte flora of the area is a composite of several floristically distinct bioregions that overlap to produce a relatively high diversity for such an arid environment. First, the moss flora of the Santa Margarita Ecological Reserve region exhibits an affinity to the Mojave Desert, which occurs to the north and east. Almost a third (30%) of the 63 species reported also occur in the Mojave (Harthill et al. 1979; Stark & Whittemore 2000). The majority (10) of these are in the families Pottiaceae and Grimmiaceae, each with xeric tendencies. However, this trend is absent among the liverworts, with only two species in common with the Mojave Desert, *Targionia hypophylla* and *Asterella californica*. The relatively high liverwort diversity reported here probably results from the cooler, wetter winter climate along with significantly greater precipitation in this region compared to the deserts. The latter species, although reported from the Mojave, may actually represent an undescribed species of *Targionia* endemic to the Mojave Desert (Whittemore 1996). Given the proximity of the Santa Margarita Reserve to the Mojave Desert, it will thus be of interest to compare the Santa Margarita specimens with those to the north and east, near Joshua Tree National Park.

Crossidium seriatum had previously been reported from southern California from only a single locality, in a desert region of eastern San Diego County. This species is a noted gypsophile and globally rare species, known from fewer than 10 populations worldwide (Baja California, Anza-Borrego Desert, southern Nevada, southern Arizona, and Spain; Zander 1977, Cano et al. 1992, Stark & Whittemore 1992, Stark 2000). Finding this species outside of its normal gypsum habitat is notable.

Secondly, a pacific coastal element is also strongly represented in the Santa Margarita Ecological Reserve bryoflora. That biogeographic element includes *Anacolia menziesii, Syntrichia princeps, Homalothecium arenarium*, and *Claopodium whippleanum*, all of which are broadly distributed along the Pacific coast. In addition to these discrete biogeographic elements, several cosmopolitan species are, not surprisingly, found in the reserve. These include *Funaria hygrometrica, Anomobryum argenteum / A. lanatum, Rosulabryum capillare, Certodon purpureus, Grimmia pulvinata, Didymodon vinealis*, and *Syntrichia ruralis*.

The Bryaceae is a particularly well represented family in the area, with thirteen species in three currently recognized genera. *Bryum caespiticium, B.bicolor, B. pseudotriquetrum, B. gemmiparum* are all relatively frequent in the area, and their collection was expected. *Bryum gemmiluscens* was a surprise because it was the most common species at the reserve and is relatively less frequent in surrounding areas. It is apparently under-collected in California and will likely be found as a prominent component of the bryoflora in other areas as well. *Bryum pyriferum* was an unexpected find. It has only recently been found for the first time in California, in the San Francisco Bay area (Shevock & Toren, 2001), and the Santa Margarita collection is only the fifth known location for this species in North America.

Three undescribed species of *Bryum* (sens. lat.) were found in addition to the known taxa. "Species B" is an interesting little species that is related to *the Bryum bicolor* group. To date it is known only from an area in west central California and from the Santa Margarita Ecological Reserve. It is very likely a California endemic. "Species C" and "Species D" are distinctive undescribed species found in rock crevices. "Species D" is somewhat similar to *Brachymenium exile*, a pantropical species that is known from Mexico. As far as "species D" is known, it is also a California endemic.
It is apparent from the results of this four-day intensive field meet that the bryophyte flora in the west is still far from well understood and documented. One of the objectives of the annual SO BE FREE meeting is to contribute to exploration and description of the flora. We welcome specialists as well as generalists, or amateurs who are interested in an overview.

Whenever bryologists turn out in force to concentrate and coordinate their observations of the western flora, new taxa, new distribution records, and rare and little-known organisms come to light. This is clearly demonstrated by the results of the 2001 meeting of SO BE FREE, and we anticipate that the 2002 meeting will just as productive. All are invited.

Acknowledgements We would like to thank Bruce Allen for his insightful comments on KLL 1394, Dan Norris for expert assistance and concurrence on several key determinations, Brent Mishler for coordinating the Sixth Annual SOBEFREE, and Claudia Luke for graciously hosting our meeting.

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Announcing

The Seventh Annual SO BE FREE Spring Outing, Botanical Excursion, Foray, Retreat, and Escape to the Environment.

Held each spring, associated with Spring Break at universities, SO BE FREE is an early spring field meeting based out of a different field station each year. The usual tradition is to have a four-day, three-night schedule with communal cooking and eating in inexpensive and remote biological field stations. Evening slide shows and informal talks are presented as well as keying sessions with microscopes. In addition to seeing interesting wild areas and learning new plants, important goals for SO BE FREE include keeping west coast bryologists (and friends) in touch with each other and teaching and encouraging students and amateurs.

In 2002 the Seventh Annual SO BE FREE will meet in the foothills of the Mayacamas Mountains at the Hopland Research and Extension Center (HREC; see http://danrrec.ucdavis.edu/hopland/home_page.html). HREC is the University of California's principal field research facility for agriculture and natural resources in the North Coast region. The Center extends over more than 5,300 acres. A diversity of soils, plant and animal communities, and elevations makes HREC representative of many parts of the Coast Range in northwestern California. The meeting will convene Saturday, 23 March 2002 at the Hopland Research and Extension Center at 4:00pm. Detailed directions about how to get there will be sent out to registrants. One full day we will be spent exploring the Mendocino coast, seeing redwood forest, deep canyons, and the famous Mendocino pygmy forest. The other full day we will go to drier interior habitats in Lake County. In the evenings we will have slide shows about bryophytes and lichens, and current research efforts of the participants followed by identification sessions.

Please inform Brent Mishler of your firm intent to attend the foray, by February 1st, 2002, at: bmishler@socrates.berkeley.edu, or by telephone 510-642-6810. Please include your mailing address and phone number, and note any special restrictions you might have on diet. For a glimpse of some of the past six outings, consult the SO BE FREE web site: http://ucjeps.herb.berkeley.edu/bryolab/trips/sobefree.html

Mosses of Worcester County Massachusetts: New Records from Old Specimens

Mary S. G. Lincoln

The mosses of Massachusetts were first cataloged by county in 1960 (Hilferty 1960). Subsequent contributions to the catalog were made by Judd (1980), Mishler and Miller (1983), Anderson et al. (1997), and Williams (2000). Additional reports were included in treatments of certain genera by Welch (1960), Ireland (1969), Shaw (1981), and Crum & Anderson (1981). A convenient county checklist (not published) based on these literature reports was compiled for the Massachusetts Natural Heritage Program by Cooper-Ellis in the late 1990s.

Though Hilferty stated that he had examined the herbarium of Clark University in Worcester, Massachusetts, it appears that a significant collection of mosses housed at Clark was not included in his study. The Hadwen Botanical Club moss collection came to the Farlow Herbarium as part of the Clark University cryptogamic herbarium at some point in the 1980s. Consisting of 845 specimens, all from Worcester County, Massachusetts, the Hadwen collection contained 157 species in 81 genera. I have not been able to solve the mystery of why this collection was not included in Hilferty's 1960 catalog. It appears he was aware of the existence of the Hadwen collection (which I believe was by then housed at Clark University) as the box containing the specimens held a handwritten note (dated 1959) from Dr. Hilferty to Dr. Burton Gates of Clark listing specimens he was borrowing. This list correlated with specimens annotated by Dr. Henry Conard in 1962.

In the process of inserting the Hadwen Collection into the Farlow general moss herbarium, I noted a number of species that had not previously been recorded for Massachusetts or for Worcester County. I examined all of these potential state and county records and found a number of misidentifications. Nevertheless, the following Worcester County records resulted:

Andraeae rupestris (Hedw.) Coll. Roberta Davis, 9/21/1956, Ashburnham previously reported from Berkshire, Franklin, Middlesex and Norfolk counties.

Bryum caespiticium Hedw. Coll. Edith Barnes, no date, Northboro, on ground at foot of trees. This species is found in ten other Massachusetts counties but has not been reported for Worcester. It was, however, found in a survey of the Devens Reserve Forces Training Area in Worcester County conducted in 1998 by Sarah Cooper-Ellis and Ray Abair.

Fissidens osmundioides Hedw. Coll. Anna Moore, 11/3/1912, Worcester Previously reported from Berkshire, Bristol, Essex, Hampden, Middlesex, Norfolk, and Suffolk counties.

Volunteer, Farlow Herbarium, Harvard University, 22 Divinity Avenue, Cambridge, MA 02138

Hygroamblystegium fluviatile (Hedw.) Loeske Coll. Roberta Davis, 7/30/56, East Princeton, on rocks in a stream Previously reported from Essex, Middlesex, Norfolk, Plymouth and Suffolk counties.

Hygrohypnum eugyrium (Schimp. in B.S.G.) Loeske Coll. Rachel L. Lowe, 6/18/1917, Princeton, on rocks in brook and 6/3/1918, Paxton, on rocks in brook

Previously reported for Berkshire, Franklin and Hampshire counties.

Orthotrichum pumilum Sw. Coll. Annie M. Small, 6/18/1900, Northboro, on rocks in meadow Previously reported for Berkshire, Bristol, and Middlesex counties.

Pohlia wahlenbergii (Web & Mohr) Andrews Coll. Rachel Lowe, 10/7/1928, Howard's Swamp, Hubbardston Previously reported for Berkshire, Bristol and Franklin counties.

Polytrichastrum alpinum (Hedw.) G.L. Sm. Coll. Rachel L. Lowe, 6/18/1917, Princeton, on Mt. Wachusett Previously reported for Berkshire, Essex, Franklin and Norfolk counties.

Pylaisiella polyantha (Hedw.) Grout Coll. Roberta Davis, 7/29/1956, Spencer, on maple tree Previously reported for Bristol, Norfolk, Plymouth and Suffolk counties.

Schistidium rivulare (Brid.) Podp. *var. rivulare* Coll. Annie M. Small, 4/28/1900, Northboro, on rock in stream Previously reported only from Franklin county.

Splachnum ampullaceum Hedw. Coll. Mrs. G.H.Kelton, 7/1924, Hubbardston

Previously reported only from Essex and Hampshire counties.

Acknowledgements. I would like to thank Susan Williams for sending me a copy of the Cooper-Ellis checklist, Ray Abair for giving me the list of species found at the Devens Reserve Forces Training Area, Don Pfister and Scott LaGreca for letting me hang around the Farlow Herbarium, and Norton Miller for confirming some troublesome determinations.

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An Unusual *Bryum* in Missouri

Carl Darigo

The genus *Bryum*, and specifically *Bryum capillare* Hedw., has historically presented taxonomic problems. Syed (1973) treated *B. capillare* in detail and Allen (1995) gives useful and practical information in his Maine key for separating *Bryum* species. Recently the author collected a moss that appeared to be *Bryum laevifilum* Syed in northeast Madison County, Missouri. The collection, Darigo 3495 (MO), was made 8 May 2000 during a Webster Groves Nature Study Society outing to the Amidon Memorial Conservation Area, on the Cedar Glades Trail. This conservation area is located in the St. Francois Mountains region of North America's Interior Highlands. The plants were growing in small, scattered patches on partially shaded, granite rocks and boulders near a glade in typical upland oak-hickory forest habitat at 800 feet.

The plants were 5-10 mm tall, branched, with slightly curled, but not twisted leaves, and had smooth, brown rhizoids. The leaves were obovate, varied from obtuse to acute or cuspidate, were widest at or above the middle, not decurrent, and 1.3-1.7 x 0.6-0.7 mm. The leaf margins were entire, plane, and weakly bordered by linear cells. The cells were smooth and thin-walled, with upper leaf cells 30-40 x 15-20 µm, and oblong basal cells 50-60 x 20-25 µm. Costae were subpercurrent, ending 5-7 cells below apex. Smooth, light brown, filamentous gemmae (15-25 µm wide) were found in leaf axils, but no rhizoidal tubers or sporophytes were seen.

The plants fit Syed's (1973) description of *Bryum laevifilum* very well, especially with the costa consistently ending below the apex, an upper cell length/width ratio of approximately 2:1, leaves not spiraled and non-decurrent, margins plane with weak linear cell border, and non-papillose gemmae. Characteristics of *B. capillare sens. strict.* normally include spiraled leaves, costa percurrent to excurrent, upper cell length/width ratio averaging 3:1, and margins slightly revolute, with weak to moderate border of linear cells. When present, rhizoidal tubers of both species are brown. Anderson *et al* (1990) has synonomized *B. laevifilum* with *B. flaccidum* Brid., but Syed (1973) points out that *B. flaccidum* differs significantly from *B. laevifilum* in having papillose gemmae, excurrent costa and decurrent leaves. Allen (1995), in comparing his results with Syed's (1973) treatment, indicates that most Maine *Bryum capillare* material closely resembles *B. flaccidum*.

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Bryum capillare is common in Missouri and the possiblity exists that upon closer examination, some of the collections named *B. capillare* could be *B. laevifilum*; MO has no collections of the species. Besides Europe, Syed (1973) reports the species in British Columbia, Arizona, Michigan and Montana, so occurrence in Missouri could be possible. Paul Redfearn examined this collection and preferred to remain with the *B. capillare* "complex" designation. While controversy may exist on *Bryum* identifications, the purpose of this paper is to highlight a species with fairly consistent and characteristic features.

Martin (2001) reported *B. flaccidum* growing on tree trunks in Ontario, with numerous gemmae occurring on the leaves instead of in the leaf axils. His observation that similar plants growing on soil or limestone had no leaf gemmae parallels the Missouri rock-based specimen which had only axillary gemmae and no leaf gemmae.

Acknowledgments: the author wishes to thank Bruce Allen for confirming the specimen, Paul Redfearn for his analysis and comments, and curators at MICH for loan of specimens.

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Rhode Island's Foliose and Fruticose lichens

Don Flenniken

This paper reports on 92 species of lichens collected in Rhode Island from June 10 through August 14, 2001. Collections were made in 48 different sites, most of which are within protected areas under the control of The Rhode Island Nature Conservancy, Rhode Island Audubon Society, State, Town, and Municipal Parks, and cemeteries.

Voucher specimens have been deposited with The Rhode Island Nature Conservancy with duplicate specimens deposited in the herbarium at the University of Rhode Island. For additional information, please contact The Rhode Island Nature Conservancy, 159 Waterman Street. Providence, RI 02906.

Species List

Identifications were made through the use of Hale (1979) and Flenniken (1999). Names follow Esslinger and Egan (1995). Collection site (by town designation) and number represent voucher specimens. Names preceded by an asterisk (*) are apparent new state records (Hinds 2001).

Allocetraria oakesiana (Tuck) Randlane & Thell. Collected once, West Greenwich #5122.
Bryoria furcellata (Fr.) Brodo & Hawksworth. Uncommon; two collection sites. Richmond #4906.
Candelaria concolor (Dickson) Stein. Uncommon; four collection sites. Burrillville #5198.
Cetraria arenaria Karnefelt. Common; ten collection sites. Exeter #5004.
Cladina arbuscula (Wallr.) Hale & Culberson. Common; fifteen collection sites. Exeter #5440.
Cladina mitis (Sandst.) Hustich. Uncommon; five collection sites. Exeter #5008.
Cladina stellaris (Opiz) Brodo. Collected once. Cumberland #5522.
Cladina submitis (A. Evans) Hale & Culberson. Uncommon; four collection sites. Richmond #5294.
Cladina subtenuis (Abbayes) Hale & Culberson. Common; seventeen collection sites. West Greenwich #5127.
**Cladonia atlantica* A. Evans. Uncommon; three collection sites. North Kingstown #5499.
Cladonia boryi Tuck. Collected once. Middletown #5364.
Cladonia caespiticia (Pers.) Florke. Uncommon; three collection sites. Lincold #5100.
Cladonia caroliniana Tuck. Common; seven collection sites. Middletown #5366.
Cladonia coniocreae (Florke) Sprengel. Very Common; twenty-two collection sites. Hopkinton #5315.

2273 Blachleyville Road. Wooster, Ohio 44691. E-mail: FlennikenD@aol.com

Cladonia conista A. Evans. Collected once. South Kingstown #4989.

Cladonia cristatella Tuck. Very common; twenty collection sites. South Kingstown #4980.

**Cladonia didyma* (Fee) Vanio. Collected once. Cumberland #4828.

Cladonia fimbriata (L.) Fr. Uncommon; two collection sites. Cumberland #5524.

**Cladonia floridana* Vanio. Collected once. North Smithville #5633.

Cladonia furcata (Hudson) Schrader. Common; nine collection sites. North Smithfield #5477.

Cladonia gracilis Florke. Uncommon; four collection sites. Hopkinton #5310.

Cladonia grayi G. Merr. *ex* Sandst. Very common; twenty-five collection sites. North Smithfield #5481.

Cladonia macilenta Hoffm. Very common; twenty-five collection sites. North Smithfield #5629.

Cladonia multiformis G. Merr. Collected once. Burrillville #5221.

**Cladonia parasitica* (Hoffm.) Hoffm. Uncommon; two collection sites. South Kingstown #4947A.

Cladonia pleurota (Florke) Schaerer. Uncommon; four collection sites. North Smithfield #5479.

Cladonia polycarpoides Nyl. Uncommon; two collection sites. South Kingstown #4978.

Cladonia pyxidata (L.) Hoffm. Uncommon; two collection sites. Gloucester #5071.

**Cladonia ramulosa* (With.) J.R. Laundon. Collected once. Coventry #5345.

Cladonia rei Schaerer. Common; six collection sites. Hopkinton #5313.

**Cladonia sobolescens* Nyl *ex* Vanio. Uncommon; four collection sites. Hopkinton #5311.

Cladonia squamosa Hoffm. Common; eleven collection sites. Hopkinton #5035.

Cladonia strepsilis (Ach.) Grognot. Uncommon; two collection sites. North Smithfield #5632.

**Cladonia turgida* Hoffm. Collected once. Johnson #5192.

Cladonia uncialis (L.) F.H. Wigg. Uncommon; two collection sites. Hopkinton #5036.

Dibaeis baeomyces (L.f.) Rambold & Hertel. Common; seventeen collections sites. Richmond #4896.

Dimelaena oreina (Ach.) Norman. Common (to very common); six collection sites (with many additional sites on tombstones where collection is prohibited). Lincoln #5101.

Evernia mesomorpha Nyl. Uncommon; two collection sites. West Greenwich #5151.

Flavoparmelia baltimorensis (Gyelnik & Foriss) Hale. Very Common; thirty-two collection sites. Charlestown #5566.

Flavoparmelia caperata (L.) Hale. Very common; thirty-nine collection sites. Coventry #5348.

**Flavopunctelia soredica* (Nyl.) Hale. Collected once. Burrillville #5206.

Hypogymnia physodes (L.) Nyl. Very Common; twenty-five collection sites. South Kingstown #4949.

Hypotrachyna livida (Taylor) Hale. Uncommon; three collection sites. Coventry #5350.

Imshaugia aleurites (Ach.) S.F. Meyer. Common; twelve collection sites. Exeter #5018.

Imshaugia placorodia (Ach.) S.F. Meyer. Common; six collection sites. West Greenwich #5136.

Lasallia papulosa (Ach.) Llano. Common; fourteen collection sites. Westerly #4852.

Lasallia pensylvanica (Hoffm.) Llano. Collected once. Middletown #5376.

**Melanelia fuliginosa* (Fr. *ex* Duby) Essl. Collected once. Burrillville #5231.

Melanelia subaurifera (Nyl.) Essl. Common; eleven collection sites. Coventry #5353.

**Myelochroa aurulenta* (Tuck.) Elix & Hale. Collected once. Charlestown #5569.

**Myelochroa galbina* (Ach.) Elix & Hale. Uncommon; two collection sites. West Greenwich #5138.

Parmelia saxatilis (L.) Ach. Common; six collection sites. Richmond #4920.

Parmelia squarrosa Hale. Very common; twenty-two collections sites. Charlestown #5571.

Parmelia sulcata Taylor. Very common; thirty-two collection sites. Tiverton #5393.

Parmotrema hypotropum (Nyl.) Hale. Common; ten collection sites. South Kingstown #4965.

Parmotrema perforatum (Jacq.) A. Massal. Uncommon; five collection sites. Charlestown #4881.

Peltigera canina (L.) Willd. Collected once. West Greenwich #5555.

Peltigera didactyla (With.) J.R. Laundon. Uncommon; two collection sites. Foster #5264.

Peltigera elizabethae Gyelnik. Collected once. West Greenwich #5552.

**Peltigera praetextata* (Florke *ex* Summerf.) Zopf. Collected once. West Greenwich #5553.

**Phaeophyscia adiastola* (Essl.) Essl. Uncommon; two collection sites. Lincoln #5107.

Phaeophyscia rubropulchra (Degel.) Essl. Common; nine collection sites. Lincoln #5108.

Physcia adscendens (Fr.) H. Olivier. Common; seven collection sites. South Kingstown #4999.

Physcia aipolia (Ehrh. *ex* Humb.) Furnr. Uncommon; five collection sites. West Greenwich #5141.

Physcia millegrana Degel. Very common; twenty-five collection sites. Portsmouth #5600.

Physcia stellaris (L.) Nyl. Common; thirteen collection sites. Burrillville #5212.

Physcia subtilis Degel. Uncommon; two collection sites. South Kingstown #5439.

**Physciella chloantha* (Ach.) Essl. Uncommon; two collection sites. North Kingstown #5518.

**Physconia detersa* (Nyl.) Poelt. Collected once. Richmond #4901.

**Physconia leucoleiptes* (Tuck.) Essl. Collected once. Glocester #5097.

**Punctelia missouriensis* Wilhelm & Ladd. Uncommon; two collection sites. Portsmouth #5601.

Punctelia rudecta (Ach.) Krog. Very Common; thirty-six collection sites. Cumberland #4841.

Punctelia subrudecta (Nyl.) Krog. Uncommon; five collection sites. Middletown #5383.

Pycnothelia papillaria Dufour. Uncommon; four collection sites. South Kingstown #4986.

**Rimelia reticulata* (Taylor) Hale & Fletcher. Collected once. Hopkinton #5335.

Tuckermannopsis americana (Sprengel) Hale. Uncommon; two collection sites. Exeter #5024.

**Tuckermannopsis ciliaris* (Ach.) Gyelnik. Collected once. West Greenwich #5163.

Tuckermannopsis fendleri (Nyl.) Hale. Uncommon; five collection sites. West Greenwich #5164.

**Umbilicaria americana* Poelt & T. Nash. Uncommon; four collection sites. Westerly #4857.

Umbilicaria mammulata (Ach.) Tuck. Common; ten collection sites. Coventry #5590.

Umbilicaria muehlenbergii (Ach.) Tuck. Collected once. Middletown #5384.

Usnea hirta (L.) F.H. Wigg. Collected once. Portsmouth #5602.

Usnea strigosa (Ach.) Eaton. Common; eighteen collection sites. Charlestown #5574.

**Usnea subfloridana* Stirton. Uncommon; three collection sites. Exeter #5026.

**Usnea subfusca* Stirton. Collected once. Richmond #5307.

Xanthoparmelia conspersa (Ehrh. *ex* Ach.) Hale. Very common; twenty-two collection sites. South Kingstown #4975.

**Xanthoparmelia cumberlandia* (Gyelnik) Hale. Uncommon; two collection sites. Lincoln #5648.

**Xanthoparmelia plittii* (Gyelnik) Hale. Common; fifteen collection sites. North Kingstown #5291.

Xanthoparmelia somloensis (Gyelnik) Hale. Common; eight collection sites. Charlestown #4887.

**Xanthoparmelia tasmanica* Hook. f. & Taylor) Hale. Common; nine collection sites. Johnson #5182.

Xanthoria parietina (L.) Th. Fr. Common; eight collection sites. Tiverton #5395.

Xanthoria polycarpa (Hoffm.) Rieber. Uncommon, two collection sites. Jamestown #5620.

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The Lichen Flora of the Lower Eastern Shore of the Delmarva Peninsula

Lance T. Biechele

Abstract. *Seventy-eight collections of lichens are reported from the lower eastern shore of Maryland on the Delmarva Peninsula. This region is the northernmost range of bald cypress* (Taxodium distichum) *swamps along the Atlantic Coastal Plain and supports a large number of lichen species.*

For the purpose of this study, the lower eastern shore of Maryland consists of four counties including Dorchester, Somerset, Wicomico and Worcester extending 110 km across and 55 km north-south between the Delaware and Virginia state lines. This region is located near the southernmost end of the Delmarva Peninsula between Chesapeake Bay and the Atlantic Ocean. The elevation, except for a few locations in Wicomico County, is generally below 40 feet above sea level. The fossil history dates back to the Miocene era.

The author has collected seventy-two species of lichens including *Brigantiaea leucoxantha, Leptogium phyllocarpum*, and *Parmotrema gardneri* which are Neotropical in origin. Additionally, six state-wide rare species: A*nzia colpodes, Coccocarpia cronia, Hypotrachyna formosana, Pannaria leucosticta, Pannaria tavaresii, and Pseudocyphellaria aurata* have also been reported from Milburn Landing, Pocomoke River State Forest and Park, and are published here for the first time (Norden, *in litt.*).

The nomenclature follows Brodo, Sharnoff and Sharnoff (2001) and those species listed in **bold print** are beautifully illustrated in their new book. Presently, all of the author's collections are maintained in his private herbarium, but will be deposited into the new science facility at Salisbury University, Salisbury, Maryland when it is completed in 2003.

Anaptychia palmatula (Michx.) Vain.: (126-89)
Baeomyces roseus Pers.; [as syn. *Dibaeis baeomyces*]: (14-86) & (18-86)
Bacidia schweinitzii (Tuck.) Schneid.: (38-86)
Brigantiaea leucoxantha (Spreng.) R. Sant. & Haffel.: (59-88)
Buellia stillingiana J. Stein: (107-88) & (134-89) Anne, Maryland 21853
Calopaca citrina (Hoffm.) Th. Fr.: (73-88)
Canoparmelia caroliniana (Nyl.) Elix & Hale: (115-89)
Cetraria fendleri (Nyl.) Tuck..; [as syn. *Tuckermannopsis fendleri*]: (119-89)
Cladonia atlantica Evans: (37-86), (57-88), (102-88) & (141-90)
Cladonia bacillaris (Ach.) Nyl.; [as syn. *C. macilenta* Hoffm.]: (52-88) & (101-88)

14011 Cooley Road, Princess

Cladonia beaumontii (Taylor) Vain.: (20-86)

Cladonia caespiticia (Pers.) Florke: (03-86), (72-88) & (142-90)

Cladonia calycantha auct.: (01-86), (02-86) & (21-86)

Cladonia cervicornis ssp.***C. verticillata*** (Hoffm.) Ahti: (19-86), (49-88) & (*s. n.* 88)

Cladonia chlorophaea (Flk.) Spreng.: (125-89)

Cladonia coniocraea (Flk.) Spreng.: (55-88)

Cladonia cristatella Tuck.: (08-86), (13-86) & (87-88)

Cladonia grayi Merr. ex. Sandst.: (04-86), (36-86) & (99-88) – det by Hale

Cladonia parasitica (Hoffm.) Hoffm.; with ***C.*** cfr. ***vulcanica*** Zoll. & Moritzi; [as *C. didyma* var. *vulcanica* (Zoll. & Moritzi) Vainio]: (84-88)

Cladonia peziziformis (With.) Laundon: (12-86), (22-86), & (93-88); also (98-88) as *C. capitata* (Michx.) Spreng. – det by Hale

Cladonia pleurota (Flk.) Schaer.: (35-86) & (92-88) – det by Hale

Cladonia polycarpoides Nyl.: (38-88), (62-88) & (71-88)

Cladonia ravenelii Tuck.: (103-88) – det by Hale

Cladonia santensis Tuck..: (97-88) – det by Hale

Cladonia squamosa (Scop.) Hoffm.: (26-86) & (63-88)

Cladonia subtenuis (des Abb) Hale; [as *Cladina subtenuis* (Abbayes) Hale & Culb.]: (44-88), (45-88), (46-88) & (132-89)

Cladonia uncialis (L.) Wigg.: (140-90)

Flavoparmelia caperata (L.) Hale: (86-88) – det by Hale

Heterodermia hypoleuca (Mühl.) Trev. (formerly *Anaptychia hypoleuca* (Mühl.) Mass.):(69-88)

Hyperphysicia syncolla (Tuck. ex Nyl.) K. Kalb.: (34-86)

Hypotrachyna livida (Taylor) Hale (=*Parmelia livida* Tayl.): (56-88), (74-88) & (90-88)

Lecanoria chlarotera Nyl, (with *L. hypocarpa* (Tuck.) Brodo: (48-88)

Lecanoria hybocarpa (Tuck.) Brodo: (40-87) & (68-88)

Lecanoria imshaugii Brodo: (10-86) & (67-88)

Lecanora strobilina (Spreng.) Kieffer: (78-88) & (131-88)

Leptogium cyanescens (Rabenh.) Körb.: (09-86), (15-86) & (28-86)

Leptogium phyllocarpum (Pers.) Mont.: (100-88) – det by Hale

Lobaria quercizans Michx.: (25-86)

Lobaria pulmonaria (L.) Hoffm.: (24-86)

Orcholechia cinera Chev.: (133-89)

Orcholechia rosella (Müll. Arg.) Vers.: (23-86)

Ochrolechia trochophora var. ***trochophora*** (Vainio) Oshio: (61-88) & (118-89)

Pannaria lurida (Mont.) Nyl.: (51-88)

Parmotrema gardneri (Dodge) Serux.: (33-86) – det by Hale

Parmotrema hypoleucinum (B. Stein) Hale: (75-88) & (76-88) – det by Hale

Parmotrema hypotropum (Nyl.) Hale;: (32-86) & (53-88) – det by Hale

Parmotrema perforatum (Jacq.) Mass.: (06-88)

Parmotrema reticulatum (Taylor) Choisy; [as syn. *Rimelia reticulata*]: (50-88), (65-88), (70-88), (136-89) & (138-89)

Parmotrema subisidiosum (Müll. Arg.) Hale; [as syn. *Rimelia subisidosa*]: (54-88)

Parmotrema xanthinum (Müll. Arg.) Hale: (64-88) – det by Hale

Peltigera neckeri Müll. Arg.: (05-86)

Peltigera praetextata (Somm.) Vain.: (110-89)

Peltigera rufescens (Weiss) Humb.: (153-93)

Pertusaria multipunctoides Dibben: (80-88)
Pertusaria **cfr.** ***opthalmiza*** (Nyl.) Nyl.: (82-88)
Phaeophysicia rubropulchra (Degel.) Essl.: (109-88)
Physicia aipolia (Ehrh.) Hampe: (58-88) & (105-88) – det by Hale
Physica millegrana Degel: (77-88) & (91-88)
Physica stellaris (L.) Nyl.: (67-88) – det by Hale
Placynthiella uliginosa (Shrader) Coppins & P. James: (113-89)
Punctelia *(=Parmelia)* ***rudecta*** (Ach.) Krog.: (29-88), (47-88), (104-88), (114-89), (117-89) & (135-89)
Punctelia *(=Parmelia)* ***subrudecta*** Nyl.: (130-89)
Pycnothelia papillaria (Ehrh.) Hoffm..: (81-88) & (89-88)
Pyxine sorediate (Ach.) Mont.: (95-88) & (137-89)
Ramalina sp. (close to ***R. americana*** Hale): (07-86)
Ramalina willeyi Howe: (60-88)
Rinodina milliaria Tuck.: (94-88)
Usnea mutabilis Stirt.: (27-86)
Usnea strigosa (Ach.) Eaton: (17-86) & (112-89)
Usnea trichodea Ach.: (11-86)
Xanthoria fallax (Hepp.) Arn.; [probably ***X. parietina*** (L.) Th. Fr. – which extends southward along the coast into the Delmarva Peninsula]: (30-86)

Acknowledgments. I am especially indebted to Irwin M. Brodo of the National Museum of Natural Sciences, Ottawa, Canada, for many years of his encouragement and kindness with determining my lichen collections. Several specimens were also identified by the late Mason E. Hale, Jr. at the Smithsonian Institution, Washington, D. C., and are annotated accordingly.

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Additions to the lichen flora of Alberta, Canada from Crowsnest Pass

Toby Spribille

Crowsnest Pass (49°39'N, 114°43'W), a major passage across the Continental Divide on the border between southwestern Alberta and southeastern British Columbia, lies at a crossroads of phytogeographical influences. The pass forms a significant gap in the nearly continuous high mountain chain which walls off the Great Plains flora from the intermontane valleys of the Rocky Mountains. High, xeric, windswept limestone outcrops tower over the pass on the eastern side, while gentler slopes covered in *Pinus contorta* forest mark the transition into the moister Elk River drainage and British Columbia on the western side. On the eastern side of the pass, forests are patchy, and consist mostly of *Abies bifolia, Picea engelmannii* and *Pinus flexilis.* Elevation is about 1615 meters.

In the course of a collecting trip to Crowsnest Pass in early 2001, the author came across at least seven epiphytic lichen species not previously reported from Alberta, and several other noteworthy species for this part of the Rocky Mountains. These include *Evernia mesomorpha*, which is rare in southern British Columbia but fairly frequent extending onto the west side of the Pass. It occurs on the twigs of *Pinus contorta* and *Pseudotsuga menziesii.* The P- form of *Hypogymnia imshaugii* ("*Hypogymnia montana*" of McCune & Goward 1994) was also found on twigs of conifers in the Pass. Several of the species reported here are frequent west of the Continental Divide in relatively moist forests; their occurrence on Crowsnest Pass suggests a local moderation of the climate due to moist, westerly winds pushing eastward through the gap in the mountains.

Species new for Alberta

The following species appear from a review of the literature not to have been reported to date from Alberta, and they are absent from the list of Alberta lichens (Anonymous 1993) and subsequent reports (Goffinet 1994). All specimens cited here were collected by the author and are deposited in the herbarium COLO.

Bryoria tortuosa (G. Merr.) Brodo & D. Hawksw. – A widespread but uncommon species of humid climates known from adjacent British Columbia (Goward 1999), northern Idaho (McCune & Goward 1995) and several localities in northwestern Montana (B. McCune, pers. comm.). On conifer twigs on flat east of Summit Lake, *10280.*

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Esslingeriana idahoensis (Essl.) Hale & M.J. Lai – Common only a few kilometers to the west in British Columbia and throughout the southern interior part of that province, this species apparently abruptly drops out east of the Continental Divide. On decorticated twigs of *Pinus contorta, 10249.*

Hypocenomyce oligospora Timdal – This recently described species (Timdal 2001) is known from Russia and widely scattered localities in the United States, but up until now only from a single Canadian specimen from British Columbia. Material from Crowsnest Pass is P+ orange, K+ yellow, C+ fleeting red, and is richly fruiting, fitting well with Timdal's description. Rare on charred, small snag, with *Cyphelium pinicola, 10258.*

Hypogymnia metaphysodes (Asah.) Rass. – A common epiphyte in intermontane forests of British Columbia and western Montana, but described as sparse east of the Continental Divide by McCune & Goward (1995). Infrequent on conifer twigs, *10256.*

Hypogymnia occidentalis L. Pike – This species is common in montane forests west of the Continental Divide but apparently has not been previously reported from east of the Divide. Rare on conifer twigs, *10257.*

Parmelia hygrophila Goward & Ahti – Primarily a species of humid intermontane *Thuja plicata* and *Tsuga heterophylla* forests, this species also is widespread in interior *Pseudotsuga menziesii* forests in the Rocky Mountain Trench of southeastern British Columbia and northwestern Montana. Although Goward & Ahti (1983) mapped the easternmost extent of the species' range as occurring in the vicinity of Crowsnest Pass (British Columbia), it has not been previously reported for Alberta. Rare, on conifer bark east of Summit Lake, *10276.*

Tuckermannopsis orbata (Nyl.) M.J. Lai – Like *Esslingeriana idahoensis*, this species is widespread in inland regions of northwestern North America where the climate is sufficiently moist. McCune (1982) considered it a species of Pacific coastal influence, although in northwestern Montana it also occurs in dry Douglas-fir forests. On decorticated conifer twigs, *10288.*

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Bryophytes of Kansas: Wilderness Park

Lorrie A. Parrish and Stephen L. Timme

Wilderness Park is located at the north edge of Crawford County, Kansas in the NE1/4 of Section 7 of Range 25 East of Township 30 South. The park consists of 41 hectares and is bordered to the east by Cow Creek, the north by McKay Street, the west by a city sewage treatment lagoon, and to the south by private land. The park was established in 1999 for hiking, biking, and nature study.

The area, as well as much of southeast Kansas, was strip mined for coal in the early 1900s and abandoned in the early 1940s. The park has not been radically disturbed since this time. The pits are oriented in a north/south direction with very steep sides, some more than 10 meters of nearly vertical drop. Trails have been established both in low areas and along the tops of artificial ridges (The top soil layers taken off the pits and deposited next to them.) In addition to the strip mines that are found in the park, there are also some bottomland forest, a small low quality prairie, and riparian habitat.

After more than 50 years of essentially no disturbance, the plants that have revegetated the park consists of both a mixture of native and non-native species. The authors have collected more than 300 taxa of vascular plants from the park. A significant area of the park is covered by *Lonicera japonica* Thunb., *Symphoricarpos orbiculatus* Moench, and *Toxicodendron radicans* (L.) O. Ktze. The most common trees include *Quercus palustris* Muench., *Ulmus rubra* Muhl., *Celtis occidentalis* L., and *Cornus drummondii* C. A. Mey.

Few bryological studies have targeted strip mines. Sanford and Timme (1999) reported a total of 71 species of mosses in 43 genera and 22 families, and 8 species of liverworts in 5 genera and 5 families from six separate strip mines totaling 586 ha in Crawford and Cherokee counties. Carvey, et al. (1977) reported 28 species of mosses in 20 genera and 15 families from coal spoils in southern Iowa. Engelmann and Weaks (1985) reported 17 species of mosses in 14 genera and 11 families, and 5 species of liverworts in 4 genera and 4 families from strip mined areas in Mingo County, West Virginia.

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The Wilderness Park study resulted in 24 species of mosses representing 19 genera and 15 families. The only liverwort represented in the park is *Frullania inflata* Gott. (Jubulaceae), a common species throughout Kansas. The most frequently encountered and "weedy" species of mosses include *Brachythecium oxycladon* (Brid.) Jaeg. & Sauerb., *Entodon seductrix* (Hedw.) C. Müll., *Plagiomnium cuspidatum* (Hedw.) T. Kop., *Atrichum angustatum* (Brid.) B. S. G., and *Weissia controversa* Hedw. *Rhizomnium punctatum* (Hedw.) T. Kop. is reported for the first time in Kansas. Redfearn (1983) indicates the species is common throughout the Interior Highlands.

The closest location in Missouri is Newton County (Redfearn 2001), approximately 50 km southeast of Wilderness Park. It was collected once within the park from a well decorticated log in bottomland woods. The collection of *Entodon cladorrhizans* (Hedw.) C. Müll. represents only a third locality for the species, having been reported from a single county in northwest Kansas and a single county in the east-central part of the state. Crawford County is only the seventh county from which *Leptobryum pyriforme* (B. S. G.) Wils. has been collected. This species is known from a few counties in northwest Kansas and a few counties in the central part of the state. No known records occur for southeast Kansas.

Below is a list of species arranged alphabetically by family, genus and species. An asterisk before a species name indicates a new Crawford County record. Following the species name is the collection number (All collections are of the first author [LAP]), followed by the species' frequency of encounter, based on collections and field observations, and their habitat within the park. Nomenclature follows Redfearn (2001) for the mosses and Schuster (1992) for the liverwort.

MOSSES

AMBLYSTEGIACEAE

Amblystegium serpens (Hedw.) B. S. G.	163	Infrequent on soil.
A. tenax (Hedw.) C. Jens.	153	Common on soil and rocks.
**A. varium* (Hew.) Lindb.	148	Common on soil.
**Campylium chrysophyllum* (Brid.) J. Lange	168	Frequent on soil.

ANOMODONTACEAE

**Anomodon minor* (Hedw.) Fuernr.	145	Infrequent tree bases.

BRACHYTHECIACEAE

Brachythecium acuminatum (Hedw.) Aust.	152	Infrequent base of trees.
B. laetum (Brid.) B. S. G.	155	Common on soil and logs.
Steereclelus serrulatus (Hedw.) Robins.	358	Frequent on soil.

BRYACEAE		
Bryum argenteum Hedw.	356	Commondisturbed soil.
B. pseudotriquetrum (Hedw.) Gaertn. et al.	165	Common on soil.
**Leptobryum pyriforme* (Hedw.) Wils.	142	One collection from base of tree.
DICRANACEAE		
Dicranella heteromalla (Hedw.) Schimp.	157	Infrequent on soil near stream.
DITRICHACEAE		
Ditrichum pallidum (Hedw.) Hampe	146	Common on soil.
ENTODONTACEAE		
**Entodon cladorrhizans* (Hedw.) C. Müll.	357	Single collection on tree trunk.
E. seductrix (Hedw.) C. Müll	154	Common soil, rocks, logs and base of trees.
FISSIDENTACEAE		
Fissidens taxifolius Hedw.	158	Common on soil.
HYPNACEAE		
Homomallium adnatum (Hedw.) Loeske	159	Infrequent on limestone and base of trees.
LESKEACEAE		
Leskea gracilescens Hedw.	167	Common on trees and limestone.
MNIACEAE		
Plagiomnium cuspidatum (Hedw.) T. Kop.	162	Common on soil.
***Rhizomnium punctatum* (Hedw.) T. Kop.	164	Single collection on soil near pit with water.
ORTHOTRICHACEAE		
Orthotrichum pusillum Mitt.	353	Common on trees.
POLYTRICHACEAE		
Atrichum angustatum (Brid.) Bruch & Schimp. in B. S. G.	160	Common on soil.
POTTIACEAE		
Syntrichia pagorum (Milde) Amann	354	Single collection from tree trunk.
Weissia controvera Hedw.	355	Common on soil.

Of the five species representing new county records, three are generally considered to be common in eastern Kansas. A review of the county dot maps in *A Synopsis of Kansas Mosses* (Churchill 1985) indicates a real lack of collecting in the state. The western half of the state is especially poorly collected. Continued studies are needed throughout Kansas to further understand the diversity and distribution of bryophytes in the state.

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Four *Verrucaria* species new to America

Othmar Breuss

Abstract. *Four pyrenocarpous lichen species,* Verrucaria bryoctona, V. phloeophila, V. viridigrana, *and* V. xyloxena, *are reported for the first time from America..*

Verrucaria is a difficult genus of crustose pyrenocarpous lichens comprising several hundred species. Most of them are saxicolous. Only about two dozens of species are yet known to occur on soil, plant debris, moss, or bark. Material recently sent to me by W.R.Buck for identification revealed two terricolous and two corticolous species earlier not reported for America (Esslinger 2001). Three of these (*Verrucaria bryoctona*, *V. viridigrana*, and *V. xyloxena*) belong to a morphologically defined group with finely granular-verrucose thalli composed of so-called goniocysts, i. e. clusters of algal cells tightly enclosed by isodiametric to oblong fungal cells. The walls of the hyphal envelope may be dark pigmented or colorless which provides a diagnostic feature. In all species described below the perithecia are rather small (up to 0.3 mm in diameter).

***Verrucaria bryoctona* (Th.Fr.) A.Orange**

> **U.S.A., West Virginia,** Tucker Co., Monongahela National Forest, Dolly Sods Wilderness, Bear Rocks, 39°03′58′′N, 79°18′06′′W, 1205 m; ericaceous heath and sandstone exposures, on soil algae, 21 April 2001, *W.R.Buck 38978, 38995* (NY); adjacent to Bear Rocks, ericaceous heath, sandstone exposures and spruce grove, on soil algae, 21 April 2001, *E.Kneiper* (NY).

Verrucaria bryoctona is characterized by having unpigmented goniocysts forming a gray-green granular thallus, broadly ovoid to subglobose, black perithecia (with a thin superficial unpigmented layer discernible in microscopical section) lacking an involucrellum, and narrowly ellipsoidal ascospores, ca. 20-27 x 5-7.5 µm, frequently with small gelatinous appendages at their ends which stain with Congo Red. Detailed illustrations are provided by Orange (1991). The species appears to be widespread in Europe.

***Verrucaria phloeophila* Breuss**

> **U.S.A., Missouri,** Ozark Co., Caney Mountain Conservation Area, off MO 181, along N side of Caney Creek at S end of High Rock Mountain, 36°40′59′′N, 92°24′10′′W, 265-290 m, dolomite exposures along small creek, on base of *Juniperus* & over *Campylium chrysophyllum*, 4 August

Naturhistorisches Museum Wien, Botanische Abt., Burgring 7, A-1010 Wien, Austria.

1999, *W.R.Buck 36031* (NY). - **North Carolina,** Mazon Co., Nantahala National Forest, trail from Tellico Gap to Wesser Bald, 35°16′N, 83°34′W, 1190-1400 m, oak woods, on *Quercus*, 30 September 1997, *W.R.Buck 32485* (NY).

Verrucaria phloeophila was described by Breuss (1998b). Thallus on bark or lignum, thin, greenish-brown, composed of small, flat or slightly convex areolae, without a visible hypothallus. Perithecia ± sunken in the thallus and substratum, almost spherical, with uniformly dark, 20-30 µm thick walls. Ascospores ellipsoidal or slightly ovoid, ca. 25-30 x 12-14 µm.

The diagnostic combination of characters of this bark or wood-inhabiting species is the relatively thick, dark perithecial wall (derived from the fusion of the dark pigmented exciple with an involucrellum completely circling around it), and comparatively large ascospores. *Verrucaria phloeophila* was previously recorded only from Portugal and Ukraine.

***Verrucaria viridigrana* Breuss**

U.S.A., Wisconsin, Sauk Co., Baraboo Hills, Hemlock Draw Preserve, over moss on tree base, 4 September 1998, *W.R.Buck 34528* (NY).

This recently described species (Breuss 1998a) grows on bark or over moss thereon and has a green thallus composed of goniocysts with unpigmented hyphal envelopes as in *Verrucaria bryoctona.* But unlike in the latter species the goniocysts of *Verrucaria viridigrana* are aggregated to form coralloid to minutely subsquamulose complexes; thus the thalli are thicker and more conspicuous than in *V. bryoctona.* The perithecia are pear- to barrel-shaped and dark throughout (with a thin superficial unpigmented layer discernible in microscopical sections as in *V. bryoctona*). The ascospores are markedly broader than in *Verrucaria bryoctona* (ca. 20-26 x 7.5-9 µm) and lack gelatinous appendages. *Verrucaria viridigrana* was so far known from a few localities in Central and Eastern Europe.

***Verrucaria xyloxena* Norman**

U.S.A., Michigan, Cheboygan Co., along road to Reese′s Bog across from Univ. of Michigan Biological Station, T.37N., R.3W., sec. 33, on sandy soil and mosses, 26 July 1974, *R.C.Harris 9241* (NY).

The species is similar to *Verrucaria bryoctona* in having a finely granular thallus and in being terricolous, but differs in its brown granules (hyphal envelope of goniocysts dark pigmented) and somewhat shorter and broader ascospores, ca. 16-23 x 6-8 µm, which lack apical appendages.

Acknowledgment. I thank Dr. William R. Buck (New York) for making the cited specimens available to me.

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Three more species of *Racomitrium* (Musci: Grimmiaceae) in Maine

Bruce Allen

Racomitrium is a sizable genus of 83 species (Bednarek-Ochyra 1999, 2000, 2000a, Crosby *et al.* 2000). The genus is found throughout the world with its highest species concentration in the temperate regions. Allen (1994) treated six Maine species of *Racomitrium*, but there are now nine species known from the State. In Maine *Racomitrium* is found from the sea coast to the area's highest mountain peaks. The genus occurs primarily on rock. In Maine one species (*R. aciculare*) is riparian, often growing submerged in streams, others occur in mesic or xeric habitats that are wet or seeping during times of rain run-off or snow melt, and some are often found in exposed places in the alpine regions.

The name *Racomitrium* combines the Greek *rhacois* (ragged, torn, tattered) with *Mitra* (hat) in reference to the fringed calyptra found in the genus.

Key to the Maine species of *Racomitrium*

1. Leaves ending in papillose hair-points 2
1. Leaves muticous or ending in toothed hair-points 3
    2. Hair-points conspicuously decurrent, forming a long, inverted V, usually erose-dentate at margins; laminal cells below hair-points smooth or with blunt papillae over the lateral cell walls ....6. *R. lanuginosum*
    2. Hair-points not or weakly decurrent, serrulate at margins; laminal cells below hair-points with stout, projecting papillae over the cell lumens .... 4. *R. canescens*
3. Leaves oblong-ligulate, ovate-elliptical or oblong-lanceolate; apices obtuse-rounded to bluntly acute, muticous; upper margins dentate 4
3. Leaves ovate-lanceolate; apices acuminate, muticous or hyaline hair-pointed; upper margins entire 5
    4. Leaves erect-appressed to imbricate when dry; apices obtuse-rounded; costae ending near the apex .... 1. *R. aciculare*
    4. Leaves at times erect-secund when dry; apices usually bluntly acute; costae mostly ½–¾ the leaf length .... 2. *R. aduncoides*
5. Leaf margins entirely or in part bistratose 6
5. Leaf margins unistratose 8

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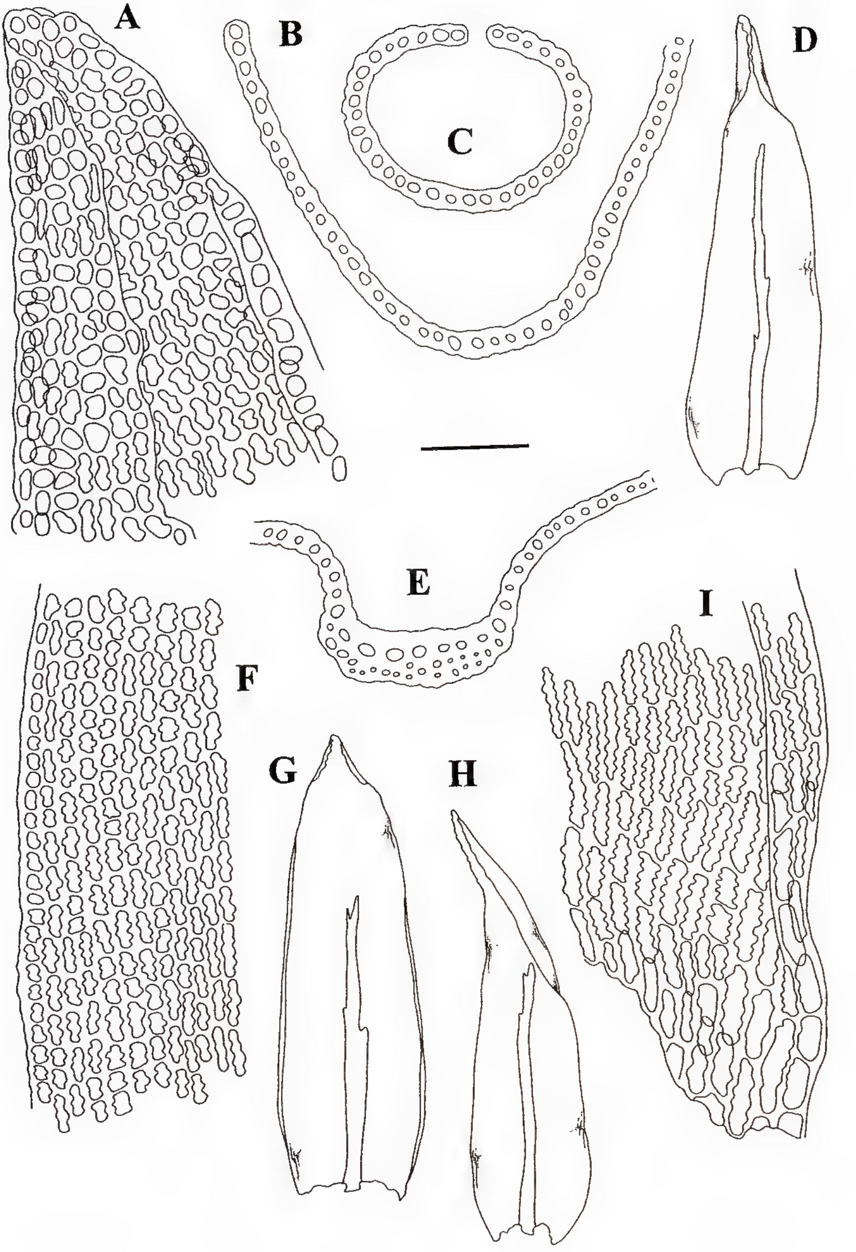
6. Leaf margins recurved ½–¾ on one side, shorter to nearly plane on the other side; inner perichaetial leaves ovate-lanceolate, hair-pointed .... 8. *R. sudeticum*
6. Leaf margins recurved nearly to the apex; inner perichaetial leaves ovate, rounded-acute to obtuse 7
7. Leaves wavy to lumpy at sides; costae 50–80 µm wide at base .. 9. *R. venustum*
7. Leaves even at sides; costae 80–110 µm wide at base .... 3. *R. affine*
8. Leaves muticous; costae 2/3–3/4 the leaf length to subpercurrent .... 5. *R. fasciculare*
8. Leaves hair-pointed; costae percurrent 9
9. Leaves at base with 8–15 basal marginal cells short-rectangular to quadrate, hyaline and esinuose; costae 60–70 wide at base .... 7. *R. microcarpon*
9. Leaves at base with basal marginal cells (except 2–5 cells at extreme base) elongate and sinuose; costae 80–110 wide at base .... 3. *R. affine*

Racomitrium aduncoides Bednarek-Ochyra, Fragm. Flor. Geobot. 44: 277–285. 1999.

Plants dark-green to yellowish green above, blackish or brownish green below, to 2 cm high. Leaves 2.5–3 mm long, erect-secund, appressed or imbricate when dry, erect-spreading when wet, ovate-elliptical to oblong-lanceolate, keeled below, weakly concave above, bluntly acute to broadly rounded, muticous; margins bluntly dentate to nearly entire above, entire below, recurved below, plane or often broadly incurved at apex, unistratose; costae ½ to ¾ the leaf length, often spurred and forked above; upper cells 10–24 µm, irregularly rounded-quadrate, rhombic to short-rectangular, with low, blunt papillae extending over the lateral cell walls; basal cells 30–50 µm, long-rectangular, alar cells often enlarged and thin-walled in decurrent auricles, or undifferentiated. Sporophytes not known from Maine, description mostly from Bednarek-Ochyra (1999). Dioicous. Setae 8–11 mm long, red when young, reddish brown to blackish brown when old, twisted clock-wise when dry, smooth. Capsules 2.0–2.3 mm long, oblong to short-cylindrical, smooth; opercula to 1.3 mm long; peristome teeth divided nearly to the base into 2 filiform, terete divisions, densely papillose, basal membrane short, finely papillose, preperistome present, equal to the basal membrane in height. Spores 14–17 µm, finely papillose. Calyptrae conical-mitriform, roughened at apex.

Figure 1. *Racomitrium aduncoides*. A. Leaf apex. B. Leaf cross-section above mid-leaf. C. Leaf cross-section at apex. D, G. & H. Leaves. E. Leaf cross-section at base. F. Median leaf cells and margin. I. Alar cells and basal leaf margin. Scale in mm: bar = 0.05 (A,F,I); bar = 0.06 (B,C,E); bar = 0.6 (D,G,H). All figures from *Allen 22191* (MO).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On stones along trail or in depressions on exposed rock outcrops.. In Maine known from Oxford (*Allen 22191* MO) County.

Racomitrium aduncoides is an eastern North American endemic recently segregated from the *R. aciculare* complex (Bednarek-Ochyra 1999). *Racomitrium aciculare* differs from it in having broader, more obtuse leaves that are erect to imbricate when dry, and costae that end near the apices. In contrast, the leaves of *R. aduncoides* are narrower, often secund when dry, and have much shorter (usually ½–¾ the leaf length), usually spurred costae. Bednarek-Ochyra (1999) also noted that the upper leaf margins of *R. aduncoides* are often strongly incurved giving the leaves a sub-cucullate appearance and its costae are often apically forked. Although these last two are distinctive features of *R. aduncoides*, both are occasionally seen in Maine collections of *R. aciculare*.

Racomitrium aciculare is usually found on rocks along stream banks or submerged in streams, and the type of *R. aduncoides* (Great Smoky Mountains, Tennessee) also came from a similar habitat. Bednarek-Ochyra (1999) found the two species at times occurred in mixed collections. Curiously, however, the two species appear to occupy different habitats in Maine and New Hampshire. *Racomitrium aciculare* as noted above is closely associated with streams, while *R. aduncoides* is more xeric and is found on rocks in the forest or in exposed, depressions in rock outcrops where it is seasonally submerged.

Racomitrium affine (Schleich. *ex* Web. & Mohr) Lindb., Acta Soc. Sci. Fenn. 10: 552. 1875.
Trichostomum affine Schleich. *ex* Web. & Mohr, Bot. Taschenbuch 127. 1807.
Racomitrium heterostichum ssp. *affine* (Schleich. *ex* Web. & Mohr) Amann, Fl. Mouss. Suisse 2: 143. 1918.

Plants dark-green above, blackish below, to 4 cm high, sparsely to subpinnately branched. Leaves 2.5–3.2 mm long, erect-incurved to somewhat imbricate when dry, erect-spreading, secund when wet, ovate-lanceolate to lanceolate, smooth or somewhat wavy along the sides above mid-leaf, channeled along the costa, acuminate, ending in denticulate, hyaline hair-points (rarely absent); margins revolute to near the apex, unistratose (rarely irregularly bistratose above), entire; costae percurrent, 80–110 µm wide at base, convex on

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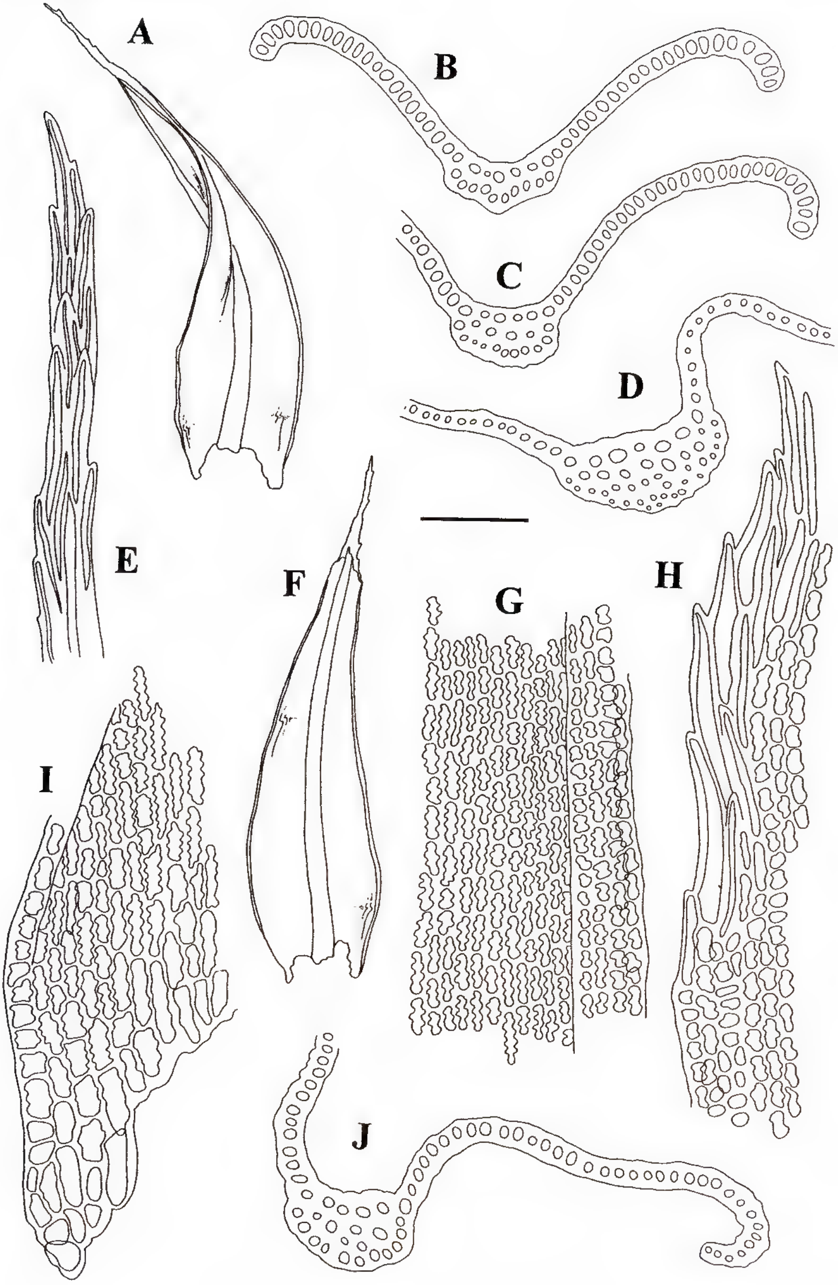
Figure 2. *Racomitrium affine*. A. & F. Leaves. B. Leaf cross-section above mid-leaf. C. Leaf cross-section near mid-leaf. D. Leaf cross-section near base. E. Leaf hair-point. G. Median leaf cells and margin. H. Leaf apex at margin showing decurrent hair-point. I. Alar cells and basal leaf margin. J. Leaf cross-section below mid-leaf. Scale in mm: bar = 0.05 (G–I); bar = 0.06 (B–D, J); bar = 0.1 (E); bar = 0.71 (A,F). All figures from *Maine Mosses 34* (MO).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the dorsal surface, plane at base on ventral surface; laminal cells smooth, upper cells 12–24 µm, rectangular to sub-rectangular; basal cells 16–32 µm, rectangular, alar cells weakly differentiated, at times slightly auriculate, with 1–5 marginal cells enlarged, thin-walled, straight-walled. Sporophytes not known from Maine, description from Frisvoll (1988). Inner perichaetial leaves strongly differentiated, ovate, muticous, hyaline. Setae 4–10 mm long. Capsules 1.5–3.2 mm long, oblong-cylindrical; peristome teeth divided into 2 divisions with median line perforated rather than continuous, papillose, basal membrane present. Spores 12–20 µm. n = 13 + m (as *R. heterostichum* var. *gracilescens* Bruch & Schimp. *in* B.S.G., Fritsch 1991).

On bare, granite rocks in seep at edge of woods just above the ocean. In Maine known from Lincoln (Allen & Pursell, *Maine Mosses 34* (as *R. venustum*) DUKE, MAINE, MO, NY, US) County.

Racomitrium affine is a blackish green moss with leaf margins revolute to near the apex, broad costae, and weakly differentiated alar cells. Although the species can have hair-pointed or muticous leaves, the leaves on plants from the only Maine locality of the species are strongly hair-pointed. Typically *R. affine* has unistratose leaf margins, but occasionally the upper margins are sporadically bistratose. *Racomitrium affine* belongs to the *heterostichum*-group of *Racomitrium* and so can be confused with *R. sudeticum, R. venustum*, and *R. microcarpon*. The first two species differ from it in having more consistently bistratose leaf margins. In addition, *R. sudeticum* has weakly revolute leaf margins and hair-pointed inner perichaetial leaves, while *R. venustum* differs in having leaves that are wavy to lumpy at the sides, and narrower costae (50–80 µm at base vs 80–110 µm at base). In both *R. microcarpon* and *R. affine* the leaf margins are usually unistratose. *Racomitrium microcarpon* differs from *R. affine* in having leaves with 8–15 short-rectangular to quadrate, hyaline and esinuose basal marginal cells.

The Maine station for *R. affine* represents a southern extension of the species range along the coast of eastern North America. It previously was known from Newfoundland and Cape Breton, Nova Scotia (Frisvoll 1988).

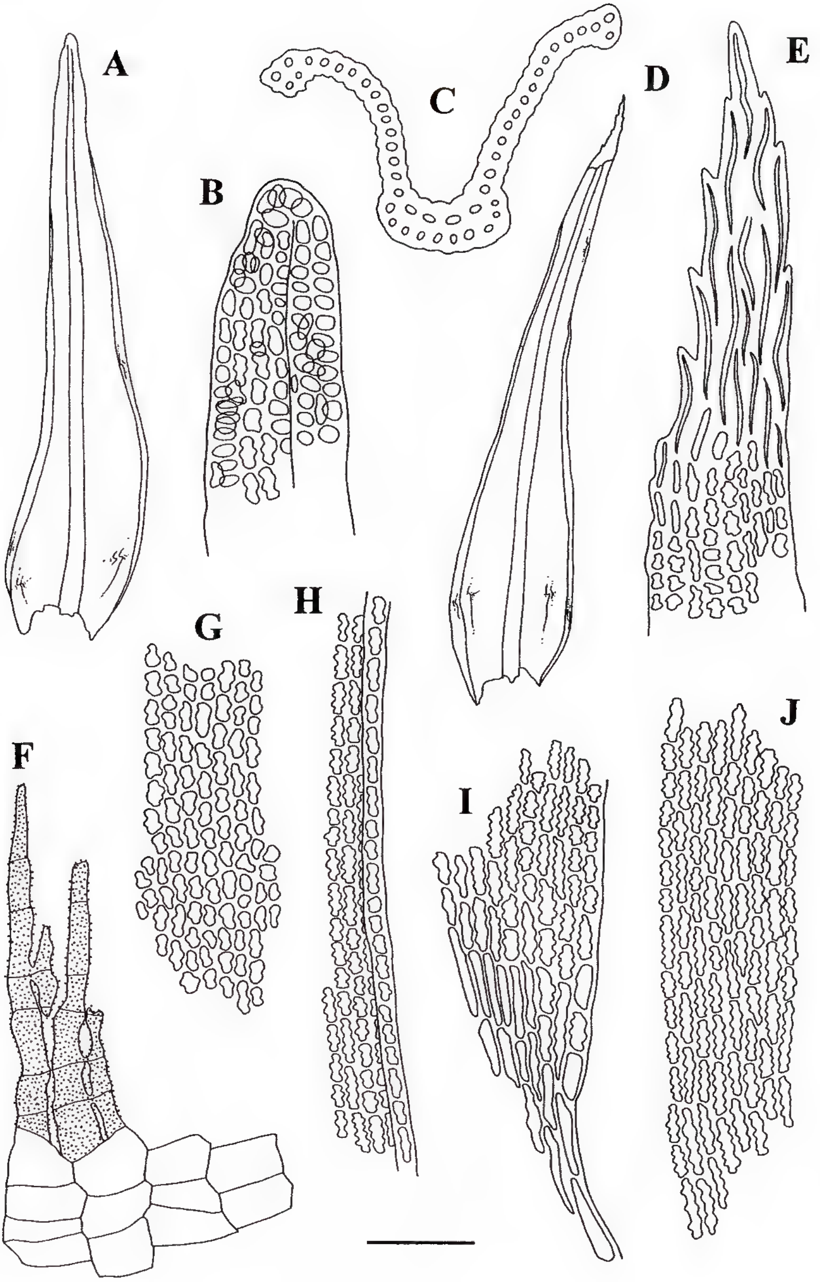
Racomitrium venustum Frisvoll, Gunneria 59: 135. 1988.

Plants green, yellowish green or blackish green, 2–6 cm high, sparsely to subpinnately branched. Leaves 1.7–2.5 mm long, loosely imbricate when dry, recurved to erect-spreading when wet, ovate-lanceolate to lanceolate, distinctly wavy or lumpy at the sides above mid-leaf, keeled, acuminate, muticous and rounded or narrowed to serrate, hyaline hair-points; both margins revolute or narrowly recurved to near the apex, partly or completely bistratose, entire; costae percurrent to excurrent into the hair-point; laminal cells smooth, upper cells 6–18 µm, irregularly isodiametric, at times oblate; basal cells 10–24 µm, rectangular, alar cells enlarged, thin-walled, straight-walled. Inner perichaetial leaves strongly differentiated, ovate, muticous, hyaline throughout. Setae 3–8 mm long, dark-red, twisted clock-wise when dry, smooth. Capsules 1.5–2 mm long, oblong-cylindrical, smooth when dry; opercula 1 mm long; peristome teeth divided nearly to the base into 2–3 linear divisions often united below by trabeculae, densely papillose. Spores 10–16 µm. Calyptrae 1 mm long, lobed at base.

On rocks and boulders in mesic woodland habitats, exposed ledges and cliff faces in seeping areas, and rocks near streams and lakes. In Maine known from Androscoggin (*Allen 14733* MO), Cumberland (*Allen 15928* MO); Franklin (*Allen 15839* MO), Hancock (*Allen 3699* MO), Knox (*Allen & Allen 6052A* MO), Lincoln (Allen & Pursell, *Maine Mosses 170* DUKE, MAINE, MO, NY, US), Oxford (*Allen 22192* MO), Piscataquis (*Lowe* MAINE), Penobscot (*Blake* MAINE), Sagadahoc (*Lowe* MAINE), Waldo (*Allen 10321* MO), Washington (*Pedano 606* MO), and York (*Allen 13053* MO) Counties.

Racomitrium venustum is found throughout the state, but it is more common in southern Maine. It has ovate-lanceolate leaves and bistratose leaf margins that are recurved to near the apex on both sides. Its leaf apices can be muticous with obtuse, rounded or sharply acute apices or hyaline hair-pointed. All leaf apical forms can be found on single plants, and although some collections are entirely muticous, most collections have at least some leaves with hyaline hair points at the tips of the branches. Collections with bistratose leaf margins only at the extreme apex can be confused with *R. microcarpon* or *R. affine*. *Racomitrium microcarpon* is best distinguished from *R. venustum* by its 8–15 short, hyaline, straight-walled cells at the extreme basal leaf margins, while *R. affine* differs in having leaves with very broad costae (80–110 µm) near the base.

Allen (1994) tentatively treated *R. venustum* within a broadly conceived *R. heterostichum* var. *sudeticum*. The *heterostichum*-species complex was admirably monographed by Frisvoll (1988) who found that *R. venustum* and *R. sudeticum* belong to different subgroups within the complex. When sporophytes are present the species can be immediately recognized by the form of their innermost perichaetial leaves. In *R. venustum* the four innermost perichaetial leaves are muticous, rounded-obtuse and strongly different from the vegetative leaves. In *R. sudeticum* the four innermost perichaetial leaves are hyaline hair-pointed and hardly different from the vegetative leaves. When sporophytes are absent the two species can be difficult to distinguish. *Racomitrium sudeticum* can also be distinguished from *R. venustum* by its less branched stems, more weakly recurved leaf margins (½–¾ the leaf length on usually one side only), and in having leaves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above mid-leaf that are more or less smooth and even at the sides. This last feature would seem to be a difficult one to evaluate, but the leaves of *R. venustum* are so wavy to lumpy on the sides that with experience the feature can be used effectively to separate the two species.

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Fritsch, R. 1991. Index to bryophyte chromosome counts. Bryophyt. Biblioth. 40: 1–352.

Figure 3. *Racomitrium venustum*. A. & D. Leaves. B. Muticous leaf apex. C. Leaf cross-section at mid-leaf. E. Leaf apex. G. Upper leaf cells. H. Basal leaf margin. I. Alar cells and basal leaf margin. J. Basal leaf cells. *Racomitrium sudeticum*. F. Peristome tooth, dorsal (outer) surface with prostome at base. Scale in mm: bar = 0.05 (B,C,E–J); bar = 0.41 (A,D). Figures A,B,G,H,J from *Allen 2437*; figures C–E from *Allen 3699*; figure I from *Allen 13053*; figure F from *Merrill 33* (all MO).

Sphagnum of the Dyken Pond Environmnetal Education Center and Adjacent Properties

William R. Town and Marilou-Pudiak Town

The Dyken Pond Environmental Education Center, consisting of 125.8 acres, is located on the north-central portion of the Rensselaer Plateau in Rensselaer County, New York. The adjacent areas include three private land parcels totaling 134 acres, a portion of the east shore of Dyken Pond and two small islands in Dyken Pond. The study area lies within the townships of Berlin, Grafton and Poestenkill. The Rensselaer Plateau is the product of geological activity which started about 550 million years ago resulting in the uplifting and thrusting of this huge block of rock (ca. 30 km. Long, 7.5 km. Wide and varying from from 30 to 305 meters thick) which is composed predominantly of sand-sized quartz particles beneath which are beds of limestone and dolostone (Isachsen, et. al., 1991; Potter, 1972). The area was glaciated 23,000 to 13,500 years ago (Potter, 1972). The study area ranges in elevation from 383.1 meters to 548.6 meters and has been shown to consist of thirty-three ecological communities (Reschke, 1990; Broderick and Ingalls, 1999). The area was surveyed for *Sphagnum* starting in 1997; to date, twenty-three different species of *Sphagnum* have been collected and identified from twenty-three different sites which represent twelve of the thirty-three different ecological communities (rocky headwater stream, marsh headwater stream, intermittent stream, reservoir/artificial impoundment, shallow emergent marsh, shrub swamp, sedge meadow, inland poor fen, red maple-hardwood swamp, hemlock-hardwood swamp and spruce-fir swamp). A total of 221 Sphagnum specimens have been collected and preserved in various herbaria. The following table (Table 1) lists the *Sphagnum* species collected to date, the number of sites found/collected at, the number of samples collected and the ranking from most common (1) to least common (15) based on the number of specimens collected and/or the number of populations collected from.

This study resulted in the discovery of five species of Sphagnum (S. *affine* Ren. & Card., *S. cuspidatum* Hoffm., *S. torreyanum* Sull., *S. viride* Flatb. and *S. warnstorfii* Russow) not found in a similar study at Grafton Lakes State Park (ca. 4 miles N.N.E. of the present study site); interestingly, *S. angustifolium* (Russow) C. Jens., *S. bartlettianum* Warnst., *S. compactum* DC, *S. flavicomans* (Card.) Warnst., *S. subfulvum* Sjors and *S. wulfianum* Girg. Were found at the Grafton Lakes State Park study site but not yet at the Dyken Pond Environmental Education Center and Adjacent Areas study site (Town et. al. 1998).

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Sphagnum species (Andrus, 1980)	collection Sites	specimens collected	Rank
S. affine Ren & Card.	*4*	*4*	*13*
S. angustifolium (Russow) C. Jens.	*3*	*4*	*13*
S. capillifolium (Ehrh.) Hedw.	8	17	4
S. centrale C. Jens.	1	1	15
S. cuspidatum Hoffm.	1	1	15
S. fallax (Klinggr.) Klinggr.	10	19	2
S. fimbriatum Wils.	10	13	6
S. flexuosum Dozy & Molk.	5	6	10
S. fuscum (Schimp.) Klinggr.	3	5	12
S. girgensohnii Russow	7	13	6
S. henryense Warnst.	1	1	15
S. isoviitae Flatb.	4	5	11
S. lescurii Sull.	5	11	7
S. magellanicum Brid.	7	9	8
S. palustre L.	18	46	1
S. recurvum P. Beauv.	10	15	5
S. russowii Warnst.	9	18	3
S. squarrosum Crome	3	3	14
S. subtile (Russow) Warnst.	4	7	9
S. teres (Schimp.) Angstr.	3	3	14
S. torreyanum Sull.	1	5	12
S. viride Flatb.	1	1	15
S. warnstorfii Russow	1	1	15

Table 1

Voucher specimens of all samples of *Sphagnum* collected at the Dyken Pond Environmental Education Center and Adjacent Areas are on file at the herbaria at S.U.N.Y. at Binghamton, the N.Y. State Museum in Albany and T.P.S., Inc. in Clifton Park.

Acknowledgments: The authors wish to thank Dr. Richard Andrus (S.U.N.Y. at Binghamton) for his help in confirming and correcting *Sphagnum* identifications, Warren Broderick (Rensselaer-Taconic Land Conservancy) for mapping and familiarizing us to the study site and Lisa Hoyt (Dyken Pond Environmental Education Center) for providing permission to collect on the study site.

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Guide to contributors to *EVANSIA*

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Revised Catalog of the Lichens and Lichenicolous Fungi of New Mexico

Robert S. Egan

Introduction. This paper is an "up date" my original catalog of New Mexico lichens (Egan 1972a). All taxa and synonyms cited in my original catalog have been revised in accordance with the most recent North American checklist (Esslinger 2001). I have listed here additional New Mexico records cited in the literature over the past 30 years. I am grateful to my former graduate student, Sara Morgan, for her help searching journals for New Mexico citations and to Cliff Wetmore who kindly sent me a data file of the New Mexico lichen collections currently housed at MIN. I have included only those species that had not been cited previously in the literature from New Mexico (citations are indicated by MIN). I have also included new additions based on collections made by Bill Buck during the 2001 ABLS field trips in New Mexico. These are indicated by the herbarium acroynym NY. New records currently housed in the my lichen herbarium at the University of Nebraska at Omaha are indicated by the acroynym OMA. In most cases I have omitted from this list subspecific epithets cited from New Mexico. These may be found in my original catalog (Egan 1972a) and in the current raw data file used to build this catalog.

This list now recognizes 698 species in 152 genera. This compares with 505 species in 75 genera in my original catalog (Egan, 1972a). I welcome additions and corrections. For those who would like more details, I would be happy to supply the current "spreadsheet" data file upon which this publication is based. Updates will be posted on my web site: www.unomaha.edu/~egan/research.htm.

Acarospora
- ***americana*** H. Magn.
- ***applanata*** H. Magn.
- ***badiofusca*** (Nyl.) Th. Fr. Thomson (1997).
- ***cinereoalba*** (Fink) H. Magn.
- ***citrina*** (Taylor) Zahlbr.
- ***clauzadeana*** (Llimona) Casares & Hafellner Syn. *Biatorella clauzadeana*. Weber & Nash (1992).
- ***fuscata*** (Schrader) Arnold Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
- ***fuscescens*** H. Magn. – MIN
- ***gallica*** H. Magn.
- ***glaucocarpa*** (Ach.) Körber Brodo et al. (2001).
- ***heufleriana*** Körber
- ***instrata*** H. Magn.
- ***interjecta*** H. Magn.

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interposita H. Magn.
interspersa H. Magn.
oligospora (Nyl.) Arnold – MIN
particularis H. Magn.
peltastica Zahlbr.
radicata H. Magn. – MIN
schleicheri (Ach.) A. Massal. Syns. *A. amabilis*, *A. bella*, *A. chrysops*, *A. evoluta*, *A. rimulosa*, *A. subcontigua*, *A. subtersa*, *A. xanthophana*, *Lecanora xanthoplana*. Nash et al. (1977), Marsh & Nash (1979), Czeczuga & Worthington (1997).
scotica Hue
smaragdula (Wahlenb.) A. Massal. Nash et al. (1977), Marsh & Nash (1979).
sparsa H. Magn.
strigata (Nyl.) Jatta Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
succedens H. Magn.
superfusa H. Magn.
tenebrica H. Magn.
tongletii H. Magn.
tucsonensis H. Magn.
veronensis A. Massal.

Agrestia
hispida (Mereschk.) Hale & Culb. Syn. *Aspicilia hispida*. Hale (1979), Goward (1999), Brodo et al. (2001).

Alectoria
nigricans (Ach.) Nyl. Brodo & Hawksworth (1977), Thomson (1984), McCune & Goward (1995), Goward (1999), Brodo et al. (2001).

Allocetraria
madreporiformis (Ach.) Kärenefelt & Thell Syn. *Dactylina madreporiformis*. McCune & Goward (1995), Goward (1999), Brodo et al. (2001).

Amandinea
dakotensis (H. Magn.) P. May & Sheard Sheard & May (1997) for map record.
punctata (Hoffm.) Coppins & Scheid. Syns. *Buellia punctata, B. punctiformis*. Marsh & Nash (1979).

Arthonia
exilis (Flörke) Anzi Syn. *Allarthonia exilis*
glebosa Tuck.
intexta Almq.
radiata (Pers.) Ach. Brodo et al. (2001).

Arthroraphis
alpina (Schaerer) R. Sant. Syns. *A. citrinella* var. *alpina*, *Bacidia alpina*.

Aspicilia
albomarginata de Lesd.
americana de Lesd. Syn. *Lecanora americana*.
caesiocinerea (Nyl. *ex* Malbr.) Arnold Syn. *Lecanora caesiocinerea*. Marsh & Nash (1979).
cinerea (L.) Körber Syn. *Lecanora cinerea*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
contorta (Hoffm.) Kremp. Brodo et al. (2001). Most North American records of *A. calcarea* (*Lecanora calcarea*) belong here (fide Wetmore).

gibbosa (Ach.) Körber
laevata (Ach.) Arnold
quartzitica W. A. Weber – MIN

Bacidia
brouardii (de Lesd.) Zahlbr. Syn. *Bilimbia brouardii*. Ekman (1996) - status uncertain, authentic material not found.
sabuletorum (Schreber) Lettau Syn. *Bilimbia sabuletorum*

Baeomyces
rufus (Hudson) Rebent. Thomson (1979, 1984), McCune & Goward (1995), Goward (1999), Brodo et al. (2001).

Bellemerea
alpina (Sommerf.) Clauzade & Roux Brodo et al. (2001).

Biatora
anthracophila (Nyl.) Hafel. Syn. *Hypocenomyce anthracophila*. Brodo et al. (2001).
turgidula (Fr.) Nyl. Marsh & Nash (1979).
vernalis (L.) Fr. Syn. *Lecidea vernalis*. Brodo et al. (2001).

Brodoa
oroarctica (Krog) Goward Syns. *Parmelia atrofusca*, *P. intestiniformis*, *Hypogymnia oroarctica*, *H. intestiniformis* and *H. atrofusca* for New Mexico records. Ohlsson (1973), Thomson (1979, 1984), Goward et al. (1994a), McCune & Goward (1995), Brodo et al. (2001).

Bryoria
chalybeiformis (L.) Brodo & D. Hawksw. Syns. *Alectoria jubata* var. *chalybeiformis*, *A. chalybeiformis*. Goward (1999).
fremontii (Tuck.) Brodo & D. Hawksw. Syn. *Alectoria fremontii*
furcellata (Fr.) Brodo & D. Hawksw. Syn. *Alectoria nidulifera*. Brodo & Hawksworth (1977), Hale (1979), Goward (1999), Brodo et al. (2001).
fuscescens (Gyelnik) Brodo & D. Hawksw. Brodo & Hawksworth (1977), Hale (1979), Brodo et al. (2001).
glabra (Mot.) Brodo & D. Hawksw. Syn. *Alectoria jubata* var. *prolixa*. Goward (1999).
lanestris (Ach.) Brodo & D. Hawksw. Brodo & Hawksworth (1977), McCune & Goward (1995), Goward (1999), Brodo et al. (2001).
nitidula (Th. Fr.) Brodo & D. Hawksw. Goward (1999).

Buellia
calcariaecola de Lesd.
erubescens Arnold Syn. *B. zahlbruckneri*. Marsh & Nash (1979).
geophila (Flörke *ex* Sommerf.) Lynge
insignis (Naeg. *ex* Hepp) Th. Fr.
jugorum (Arnold) Arnold Anderson (1974), Goward et al. (1996).
lacteoidea de Lesd.
nantiana de Lesd.
novomexicana de Lesd. Nash et al. (1977), Marsh & Nash (1979).
retrovertens Tuck. Syns. *B. cinereo-glauca*, *B. pueblae*. Nash et al. (1977), Marsh & Nash (1979).
saxicola de Lesd.
semitensis Tuck.
silicicola de Lesd.
smaragdula de Lesd..

- ***spuria*** (Schaerer) Anzi Brodo et al. (2001).
- ***triphragmioides*** Anzi
- ***vilis*** Th. Fr.

Calicium

- ***trabinellum*** (Ach.) Ach. – NY

Caloplaca

- ***albovariegata*** (de Lesd.) Wetmore Syn. *Pyrenodesmia albovariegata*
- ***ammisophila*** (Wahlenb.) H. Olivier
- ***approximata*** (Lynge) H. Magn. Thomson (1997).
- ***arenaria*** (Pers.) Müll. Arg. Marsh & Nash (1979), Brodo et al. (2001).
- ***arizonica*** H. Magn. Marsh & Nash (1979).
- ***atroalba*** (Tuck.) Zahlbr. Marsh & Nash (1979).
- ***cerina*** (Ehrh. *ex* Hedwig) Th. Fr. Syn. *C. stillicidiorum.* Thomson (1979, 1997), Marsh & Nash (1979), Brodo et al. (2001).
- ***chrysophthalma*** Degel.
- ***cinnabarina*** (Ach.) Zahlbr. Syns. *C. intermedia, Placodium cinnabarinum, P. intermedium.* Wetmore (1999).
- ***citrina*** (Hoffm.) Th. Fr. Wetmore (2001), Brodo et al. (2001).
- ***decipiens*** (Arnold) Blomb. & Forss. Marsh & Nash (1979), Thomson (1997).
- ***dispersa*** de Lesd.
- ***epithallina*** Lynge Marsh & Nash (1979), Brodo et al. (2001).
- ***ferracissima*** H. Magn. Brodo et al. (2001).
- ***ferruginea*** (Hudson) Th. Fr. Syn. *Placodium ferrugineum.* Marsh & Nash (1979).
- ***flavorubescens*** (Hudson) J. R. Laundon Brodo et al. (2001).
- ***flavovirescens*** (Wulfen) Dalla Torre & Sarnth Brodo et al. (2001).
- ***fraudans*** (Th. Fr.) H. Olivier
- ***holocarpa*** (Hoffm. *ex* Ach.) M. Wade Syn. *C. pyracea.* Marsh & Nash (1979).
- ***jungermanniae*** (Vahl) Th. Fr.
- ***lactea*** (A. Massal.) Zahlbr.
- ***lobulata*** (Flörke) de Lesd. Syn. *Placodium lobulatum*
- ***microphyllina*** (Tuck.) Hasse Marsh & Nash (1979), Czeczuga & Worthington (1997).
- ***modesta*** (Zahlbr.) Fink Marsh & Nash (1979), Nash et al. (1977).
- ***pellodella*** (Nyl.) Hasse Syn. *C. amabilis.* Marsh & Nash (1979), Wetmore (1996), Brodo et al. (2001).
- ***pinicola*** H. Magn. Marsh & Nash (1979).
- ***rubelliana*** (Ach.) Lojka Wetmore (1999).
- [***Blastenia rubrofusca***]
- ***saxicola*** (Hoffm.) Nordin Syns. *C. discerenda, Placodium lobulatum* var. *obliteratum, P. murorum.* Hale (1979), Wetmore & Kärnefelt (1998).
- ***sideritis*** (Tuck.) Zahlbr. Wetmore (1996).
- [***Pyrenodesmia montana***] Wetmore (1996).
- ***sinapisperma*** (Lam. & DC.) Maheu & Gillet – OMA.
- ***squamosa*** (de Lesd.) Zahlbr. Syn. *Placodium squamosum*
- ***subsoluta*** (Nyl. *ex* Wedd.) Zahlbr. – MIN. Syn. *Blastenia novomexicana* (fide Wetmore).
- ***tiroliensis*** Zahlbr.
- ***tominii*** Savicz Wetmore (2001).

trachyphylla (Tuck.) Zahlbr. Marsh & Nash (1979), Nash & Sommerfield (1981), Wetmore & Kärnefelt (1998), Brodo et al. (2001).
ulmorum (Fink) Fink – MIN
urceolata de Lesd.
variabilis (Pers.) Müll. Arg. Syn. *Pyrenodesmia variabilis*
vitellinula (Nyl.) H. Olivier
wrightii (Willey) Fink Syn. *Placodium ferrugineum* var. *wrightii*

Candelaria
concolor (Dickson) Stein Hale (1979), Brodo et al. (2001).
fibrosa (Fr.) Müll. Arg. Brodo et al. (2001).

Candelariella
aurella (Hoffm.) Zahlbr. Marsh & Nash (1979), Brodo et al. (2001).
citrina de Lesd.
deflexa (Nyl.) Zahlbr. Marsh & Nash (1979).
rosulans (Müll. Arg.) Zahlbr. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
stenospora de Lesd.
subdeflexa (Nyl.) Lettau
terrigena Räsänen Thomson (1979, 1997), Brodo et al. (2001).
vitellina (Hoffm.) Müll. Arg. Syn. *Placodium vitellinum*. Brodo et al. (2001).
xanthostigma (Ach.) Lettau Thomson (1997).

Candelina
submexicana (de Lesd.) Poelt Syn. *Caloplacopsis submexicanus*. Nash et al. (1977), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).

Canomaculina
subtinctoria (Zahlbr.) Elix Syn. *Parmotrema subtinctorium*. Hale (1979), Brodo et al. (2001).

Canoparmelia
texana (Tuck.) Elix & Hale Brodo et al. (2001).

Carbonea
vorticosa (Flörke) Hertel Syn. *Lecidea vorticosa*. Thomson (1979).

Catapyrenium
andicola Breuss Breuss & McCune (1994).
cinereum (Pers.) Körber Syns. *Dermatocarpon cinereum*, *D. hepaticum*, *Endopyrenium hepaticum*.
compactum (A. Massal.) R. Sant. Syn. *Dermatocarpon compactum*, *D. rupicola*, *Endocarpon americanum*, *E. rupicola*, *Verrucaria compacta*. Marsh & Nash (1979), Thomson (1987), McCune & Goward (1995).
daedaleum (Kremp.) Stein
granulosum (de Lesd.) J. W. Thomson Syns. *Dermatocarpon granulosum*, *Endocarpon granulosum*, *E. crustaceum*. Thomson (1987).
psoromoides (Borrer) R. Sant. – NY
squamellum (Nyl.) J. W. Thomson Syn. *Dermatocarpon squamellum*

Cetraria
aculeata (Schreber) Fr. Syns. *Cornicularia aculeata*, *Coelocaulon aculeatum*. Goward (1999), Kärnefelt (1986), St. Clair (1999).
ericetorum Opiz Syn. *C. islandica* subsp. *crispa*. Kärnefelt (1979), St. Clair (1999), Brodo et al. (2001).

islandica (L.) Ach. Kärnefelt (1979), Hale (1979), Thomson (1984), St. Clair (1999).
muricata (Ach.) Eckfeldt Syn. *Coelocaulon muricatum.* Kärnefelt (1986).

Cetrelia
olivetorum (Nyl.) Culb. & C. Culb. Syn. *Parmelia olivaria.* New Mexico record is unlikely.

Chaenotheca
brunneola (Ach.) Müll. Arg. – NY
furfuracea (L.) Tibell Brodo et al. (2001).

Chrysothrix
candelaris (L.) J. R. Laundon Brodo et al. (2001).

Cladonia
cariosa (Ach.) Sprengel Thomson (1979, 1984), Hale (1979), Goward (1999), Brodo et al. (2001).
cenotea (Ach.) Schaerer Brodo et al. (2001).
cervicornis (Ach.) Flotow subsp. ***verticillata*** (Hoffm.) Ahti Hale (1979), Goward (1999).
chlorophaea (Flörke *ex* Sommerf.) Sprengel Syn. *C. pyxidata* var. *chlorophaea.* Hale (1979), Goward (1999), Brodo et al. (2001).
coccifera (L.) Willd. Hale (1979).
coniocraea (Flörke) Sprengel Hale (1979), Marsh & Nash (1979), Czeczuga & Worthington (1997), Goward (1999), Brodo et al. (2001).
cornuta (L.) Hoffm. Brodo et al. (2001).
deformis (L.) Hoffm. Hale (1979), Goward (1999), Brodo et al. (2001).
didyma (Fée) Vainio Hale (1979).
digitata (L.) Hoffm.
ecmocyna Leighton Goward (1999).
fimbriata (L.) Fr. Hale (1979), Goward (1999).
furcata (Hudson) Schrader Hale (1979).
gracilis (L.) Willd.
macilenta Hoffm. var. ***bacillaris*** (Genth) Schaerer Syn. *C. bacillaris.* Hale (1979), Goward (1999), Brodo et al. (2001).
mateocyatha Robbins
multiformis G. Merr. Goward (1999), Brodo et al. (2001).
ochrochlora Flörke Syn. *C. fimbriata* var. *ochrochlora.* Goward (1999).
phyllophora Hoffm. Syn. *C. degenerans.* Goward (1999), Brodo et al. (2001).
pleurota (Flörke) Schaerer Hale (1979).
pocillum (Ach.) Grognot Syn. *C. pyxidata* var. *pocillum.* Goward (1999), Brodo et al. (2001).
pyxidata (L.) Hoffm. Marsh & Nash (1979), Hale (1979), Goward (1999), Brodo et al. (2001).
rei Schaerer Syn. *C. fimbriata* var. *subulata* f. *fibula*
robbinsii A. Evans – MIN
strepsilis (Ach.) Grognot
subulata (L.) F. H. Wigg. Syns. *C. fimbriata* var. *radiata, C. fimbriata* var. *subulata.* Goward (1999).
sulphurina (Michaux) Fr. Brodo et al. (2001).

Coccocarpia

erythroxyli (Sprengel) Swinscow & Krog Syn. *C. pellita* var. *parmelioides*. Brodo et al. (2001).

palmicola (Sprengel) Arv. & D. J. Galloway Syn. *C. cronia*. Hale (1979), Brodo et al. (2001).

Collema

coccophorum Tuck. Syns. *C. dubium*, *C. novomexicanum*. Marsh & Nash (1979), Brodo et al. (2001).

conglomeratum Hoffm. Hale (1979), Czeczuga & Worthington (1997).

crispum (Hudson) F. H. Wigg. Goward et al. (1994a), McCune & Goward (1995).

cristatum (L.) F. H. Wigg. Brodo et al. (2001).

flaccidum (Ach.) Ach. Syn. *C. rupestre*

furfuraceum (Arnold) Du Rietz Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), St. Clair (1999), Brodo et al. (2001).

fuscovirens (With.) J. R. Laundon Syns. *C. furvum*, *C. tuniforme*. Marsh & Nash (1979), Hale (1979).

nigrescens (Hudson) DC.

occultatum Bagl. – MIN

polycarpon Hoffm. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).

ryssoleum (Tuck.) A. Schneider Hale (1979).

subflaccidum Degel. – MIN

tenax (Sw.) Ach. Syns. *C. pulposum*, *C. cristatellum*. Marsh & Nash (1979), Goward et al. (1994a), Brodo et al. (2001).

texanum Tuck. Czeczuga & Worthington (1997).

undulatum Laurer *ex* Flotow Marsh & Nash (1979).

Cyphelium

lucidum (Th. Fr.) Th. Fr. Brodo et al. (2001).

tigillare (Ach.) Ach. – MIN.

Dermatocarpon

luridum (With.) J. R. Laundon Syn. *D. fluviatile*. Hale (1979).

miniatum (L.) W. Mann Syns. *Entostelia miniata*, *Endocarpon miniatum*. Nash et al. (1977), Marsh & Nash (1979), Hale (1979), Nash & Sommerfield (1981), Czeczuga & Worthington (1997), Brodo et al. (2001).

moulinsii (Mont.) Zahlbr. Marsh & Nash (1979), Hale (1979).

reticulatum H. Magn. Marsh & Nash (1979), Goward et al. (1994a), Brodo et al. (2001).

[***Entostelia saxicola***]

vellereum Zschacke Marsh & Nash (1979).

Dimelaena

oreina (Ach.) Norman Syns. *Rinodina hueana*, *R. novomexicana*, *R. oreina*, *R. suboreina*. Sheard (1974) reports the stictic-norstictic acid strain, Sheard (1977), Nash et al. (1977), Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).

Diploschistes

actinostomus (Ach.) Zahlbr. Nash et al. (1977), Marsh & Nash (1979).

diacapsis (Ach.) Lumbsch Brodo et al. (2001).

muscorum (Scop.) R. Sant. Syn. *D. bryophilus*. Brodo et al. (2001).

scruposus (Schreber) Norman Syn. *Urceolaria scruposa.* Marsh & Nash (1979), Brodo et al. (2001).

Diplotomma

alboatrum (Hoffm.) Flotow Syn. *Buellia alboatra.* Marsh & Nash (1979).

venustum (Körber) Körber – MIN

Dirinaria

frostii (Tuck.) Hale & Culb. Hale (1979).

Endocarpon

adscendens (Anzi) Müll. Arg.

pulvinatum Th. Fr. Brodo et al. (2001).

pusillum Hedwig Nash et al. (1977), Marsh & Nash (1979), Goward et al. (1994a), Brodo et al. (2001).

Ephebe

lanata (L.) Vainio Hale (1979), Goward (1999).

Euopsis

pulvinata (Schaerer) Nyl. Syn. *Omphalaria pulvinata*

Evernia

divaricata (L.) Ach. Syn. *Letharia divaricata.* Thomson (1984), McCune & Goward (1995), St. Clair (1999), Goward (1999), Brodo et al. (2001).

mesomorpha Nyl. Czeczuga & Worthington (1997).

Flavocetraria

cucullata (Bellardi) Kärnefelt & Thell Syn. *Cetraria cucullata.* Thomson (1979, 1984), Goward et al. (1994a), McCune & Goward (1995), Brodo et al. (2001).

nivalis (L.) Kärnefelt & Thell Syn. *Cetraria nivalis.* Thomson (1979, 1984), Goward et al. (1994a), McCune & Goward (1995), Brodo et al. (2001).

Flavoparmelia

baltimorensis (Gyelnik & Fóriss) Hale Syn. *Pseudoparmelia baltimorensis.* Hale (1979), Brodo et al. (2001).

caperata (L.) Hale Syns. *Parmelia caperata, Pseudoparmelia caperata.* Hale (1979), Brodo et al. (2001).

rutidota (Hook. f. & Taylor) Hale – MIN

Flavopunctelia

flaventior (Stirton) Hale Syns. *Parmelia kernstockii, P. flaventior.* Nash et al. (1977), Hale (1979), St. Clair (1999), Brodo et al. (2001).

praesignis (Nyl.) Hale Syn. *Parmelia praesignis.* Hale (1979), Triebel et al. (1995), Czeczuga & Worthington (1997), Brodo et al. (2001), Tucker (2001).

soredica (Nyl.) Hale Syns. *Parmelia ulophyllodes, P. soredica.* Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), St. Clair (1999), Brodo et al. (2001).

Fulgensia

derertorum (Tomin) Poelt Marsh & Nash (1979), Brodo et al. (2001).

fulgens (Sw.) Elenkin

Fuscopannaria

californica (Tuck.) P. M. Jørg. Jørgensen (2000).

leucophaea (Vahl) P. M. Jørg. Syns. *Parmeliella microphylla, Pannaria microphylla.* Brodo et al. (2001).

leucositcta (Tuck.) P. M. Jørg. Syn. *Pannaria leucosticta*

praetermissa (Nyl.) P. M. Jørg. Syn. *Parmeliella praetermissa*

Glypholecia
  scabra (Pers.) Müll. Arg. Marsh & Nash (1979).
Haematomma
  fenzlianum Massal. Syn. *H. subpuniceum* (Müll. Arg.) de Lesd. St. Clair (1999), Brodo et al. (2001).
  persoonii (Fée) A. Massal. Syn. *Lecanora punicea*
Hafellia
  disciformis (Fr.) Marbach & Sheard Syn. *Buellia disciformis*. Brodo et al. (2001).
Heppia
  conchiloba Zahlbr. Syn. *H. macrospora*
  lutosa (Ach.) Nyl. Syn. *H. despreauxii*. Nash et al. (1977), Marsh & Nash (1979), Hale (1979).
Heterodermia
  albicans (Pers.) Swinscow & Krog Czeczuga & Worthington (1997).
  diademata (Taylor) D. D. Awasthi Hale (1979), Brodo et al. (2001).
  hypoleuca (Muhl.) Trevisan Syns. *Anaptychia hypoleuca, Physcia hypoleuca*. Brodo et al. (2001).
  japonica (Sato) Swinscow & Krog Moberg & Nash (1999).
  leucomela (L.) Poelt Syns. *H. leucomelaena, Physcia speciosa* var. *leucomela, Anaptychia leucomelaena*. Hale (1979).
  obscurata (Nyl.) Trevisan Hale (1979), Brodo et al. (2001).
  rugulosa (Kurok.) Trass Hale (1979), Moberg & Nash (1999).
  speciosa (Wulfen) Trevisan Syn. *Anaptychia speciosa*. Hale (1979).
  squamulosa (Degel.) Culb. St. Clair (1999).
  tropica (Kurok.) Kurok. Syn. *Anaptychia tropica*
Hyperphyscia
  adglutinata (Flörke) H. Mayrh. & Poelt Syn. *Physcia adglutinata*. Brodo et al. (2001).
  syncolla (Tuck. *ex* Nyl.) Kalb. Brodo et al. (2001).
Hypocenomyce
  praestabilis (Nyl.) Timdal – MIN
  scalaris (Ach.) M. Choisy Syns. *Lecidea scalaris, Psora scalaris*. Hale (1979), Brodo et al. (2001).
Hypogymnia
  austerodes (Nyl.) Räsänen Syn. *Parmelia austerodes*. Ohlsson (1973), Thomson (1984), St. Clair (1999), Brodo et al. (2001).
  bitteri (Lynge) Ahti Syns. *Parmelia obscurata*. Ohlsson (1973), Hale (1979), Thomson (1979, 1984), Brodo et al. (2001).
  farinacea Zopf Syns. *H. bitteriana, Parmelia bitteriana, P. farinacea*
  physodes (L.) Nyl. Syn. *Parmelia physodes*. Hale (1979), St. Clair (1999), Thomson (1979), Brodo et al. (2001).
  subobscura (Vainio) Poelt
Hypotrachyna
  pulvinata (Fée) Hale Syn. *Parmelia pulvinata*. Hale (1979), Brodo et al. (2001).
  revoluta (Flörke) Hale Syn. *Parmelia revoluta*. Brodo et al. (2001).
Icmadophila
  ericetorum (L.) Zahlbr. Brodo et al. (2001).
Imshaugiaaleurites (Ach.) S. F. Meyer Syn. *Parmeliopsis aleurites*. Goward et al. (1994a), St. Clair (1999), Brodo et al. (2001).

placorodia (Ach.) S. F. Meyer Syn. *Parmeliopsis placorodia*. Hale (1979), St. Clair (1999), Brodo et al. (2001).

Invoucropyrenidium

waltheri (Kremp.) Breuss Syns. *Dermatocarpon waltheri, Catapyrenium waltheri*. Anderson (1974). Thomson (1989) considers Anderson's reports to be *Catapyrenium cinereum*. However, Breuss & McCune (1994) consider *C. waltheri* to be a distinct species.

Japewia

tornoënsis (Nyl.) Tønsberg Brodo et al. (2001).

Lasallia

papulosa (Ach.) Llano Syns. *Umbilicaria pustulata* var. *papulosa, Umbilicaria papulosa*. Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).

pensylvanica (Hoffm.) Llano Brodo et al. (2001).

Lecania

erysibe (Ach.) Mudd

subcaesia (Nyl.) de Lesd.

Lecanora

albella (Pers.) Ach. – OMA

argentea Oksner & Volkova Syn. *L. fuliginosa*. Brodo (1984), Thomson (1997).

argopholis (Ach.) Ach. Syn. *L. frustulosa* var. *argopholis*. Nash et al. (1977), Marsh & Nash (1979), Nash & Sommerfield (1981), Brodo et al. (2001).

bipruinosa Fink Czeczuga & Worthington (1997).

[***Parmularia brouardii***]

caesiorubella Ach. subsp. **saximontana** Imshaug & Brodo

carpinea (L.) Vainio Marsh & Nash (1979).

cenisia Ach. Nash et al. (1977), Marsh & Nash (1979), Brodo (1984), Brodo et al. (2001).

chlarotera Nyl. Marsh & Nash (1979), Brodo (1984), Czeczuga & Worthington (1997).

circumborealis Brodo & Vitik. Thomson (1997), Brodo (1984), Brodo et al. (2001).

coniferarum Printzen Printzen (2001).

crenulata Hook. Marsh & Nash (1979).

dispersa (Pers.) Sommerf. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).

elmorei E. D. Rudolph

epibryon (Ach.) Ach. Thomson (1979), St. Clair (1999).

garovaglii (Körber) Zahlbr. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).

glabrata (Ach.) Malme Syn. *L. subfusca* var. *glabrata*

hagenii (Ach.) Ach. Marsh & Nash (1979).

horiza (Ach.) Lindsay Syn. *L. parisiensis*

impudens Degel. Syn. *L. chloropolia*. Brodo (1984).

intricata (Ach.) Ach. Syn. *L. mutabilis* Sommerf. Marsh & Nash (1979).

marginata (Schaerer) Hertel & Rambold Syns. *Lecidea elata, L. marginata*. Brodo et al. (2001).

muralis (Schreber) Rabenh. Syn. *Parmularia muralis*. Nash et al. (1977), Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).

novomexicana H. Magn. Syn. *L. thomsonii*, *Parmularia novomexicana* de Lesd. Weber (1975), Hale (1979), Marsh & Nash (1979), Nash & Sommerfield (1981), Czeczuga & Worthington (1997), Brodo et al. (2001).
phaedrophthalma Poelt Syn. *L. christoi*. Marsh & Nash (1979).
piniperda Körber Marsh & Nash (1979).
polytropa (Hoffm.) Rabenh. Brodo et al. (2001).
pringlei (Tuck.) Lamb
pulicaris (Pers.) Ach. Syns. *L. coilocarpa*, *L. chlarona*. Marsh & Nash (1979).
rugosella Zahlbr. Brodo (1984).
rupicola (L.) Zahlbr. Syn. *L. glaucoma*. Marsh & Nash (1979), Brodo et al. (2001).
saligna (Schrader) Zahlbr. Marsh & Nash (1979), Goward et al. (1996).
symmicta (Ach.) Ach.
valesiaca (Müll. Arg.) Stizenb. Ryan (1990).
viriduloflava de Lesd. Brodo (1984).

Lecidea
atrobrunnea (Ramond *ex* Lam. & DC.) Schaerer Thomson (1979), Marsh & Nash (1979), Czeczuga & Worthington (1997).
auriculata Th. Fr. Goward et al. (1996).
hassei Zahlbr. Syn. *L. auriculata* f. *cinereo-ochracea*
lapicida (Ach.) Ach. Thomson (1979, 1997).
lithophila (Ach.) Ach.
lurida (Ach.) DC. Syn. *Psora lurida* var. *americana*
lyngei Degel.
plana (J. Lahm) Nyl.
praenubila Nyl. Syn. *L. aeneola*
syncarpa Zahlbr. – OMA
tessellata Flörke Syn. *L. cyanea*. Marsh & Nash (1979), Brodo et al. (2001).

Lecidella
anomaloides (A. Massal.) Hertel & R. Kilias Syn. *Lecidea goniophila*. Thomson (1979).
carpathica Körber Syn. *Lecidea latypiza*. Marsh & Nash (1979).
chodatii (Samp.) Knoph & Hertel – MIN
euphorea (Flörke) Hertel Syns. *L. glomerulosa*, *Lecidea glomerulosa*. Marsh & Nash (1979), Czeczuga & Worthington (1997).
patavina (A. Massal.) Knoph & Leuckert Syns. *Lecidea alaiensis*, *L. endolithea*
stigmatea (Ach.) Hertel & Leuckert Syn. *Lecidea stigmatea*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
viridans (Flotow) Körber Marsh & Nash (1979).
wulfenii (Hepp) Körber Syn. *Lecidea heppii*

Lepraria
frigida J. R. Laundon – OMA
incana (L.) Ach. Marsh & Nash (1979).
neglecta (Nyl.) Erichsen

Leprocaulon
albicans (Th. Fr.) Nyl. *ex* Hue Syn. *Stereocaulon albicans*. Hale (1979), Goward (1999).
gracilescens (Nyl.) Lamb & Ward Brodo et al. (2001).

microscopicum (Vill.) Gams *ex* D. Hawskw. Syn. *Stereocaulon nanum*. Goward (1999).

Leproloma

vouauxii (Hue) J. R. Laundon Syn. *Lepraria arctica*

Leptogium

arsenei Sierk

austroamericanum (Malme) C. W. Dodge Brodo et al. (2001).

azeureum (Sw.) Mont. Brodo et al. (2001).

burgessii (L.) Mont. Syn. *L. inflexum*. Hale (1979), Brodo et al. (2001).

burnetiae C. W. Dodge Hale (1979), Goward et al. (1994a).

cyanescens (Rabenh.) Körber Hale (1979).

denticulatum Tuck. Czeczuga & Worthington (1997).

gelatinosum (With.) J. R. Laundon Syns. *L. sinuatum*, *L. scoticum*. Goward et al. (1994a).

hirsutum Sierk

lichenoides (L.) Zahlbr. Hale (1979), Brodo et al. (2001).

milligranum Sierk Brodo et al. (2001).

papillosum (de Lesd.) C. W. Dodge Czeczuga & Worthington (1997).

platynum (Tuck.) Herre Brodo et al. (2001).

polycarpum P. M. Jørg. & Goward Brodo et al. (2001).

pseudofurfuraceum P. M. Jørg. Syn. *L. furfuraceum* for North American records. Brodo et al. (2001).

rugosum Sierk Brodo et al. (2001).

saturninum (Dickson) Nyl. Syn. *L. myochroum* var. *saturninum*. Goward et al. (1994a), Thomson (1979), Brodo et al. (2001).

Leucoparpia

biatorella (Arnold) Vězda Buck & Harris (2001).

Lichenodiplis

lecanorae (Vouaux) Dyko & D. Hawksw. – NY

Lichenostigma

maureri Hafellner – NY

Lichenothelia

scopularia (Nyl.) D. Hawksw. – MIN

Lichinella

nigritella (Lettau) Moreno & Egea Syns. *Gonohymenia nigritella*, *Thyrea nigritella*. Nash et al. (1977), Czeczuga & Worthington (1997), Brodo et al. (2001).

Lobaria

quercizans Michaux Syn. *Sticta quercizans*. New Mexico record doubtful.

scrobiculata (Scop.) DC. – MIN

Lobothallia

alphoplaca (Wallenb.) Hafellner Syns. *Parmularia alphoplaca*, *Lecanora alphoplaca*, *L. thamnoplaca*. Nash et al. (1977), Marsh & Nash (1979), Nash & Sommerfield (1981), Brodo et al. (2001).

melanaspis (Ach.) Hafellner Syn. *Lecanora melanaspis*

radiosa (Hoffm.) Hafellner Syn. *Parmularia radiosa*

Megaspora

verrucosa (Ach.) Hafellner & V. Wirth Syns. *Pachyospora verrucosa*, *Lecanora* *verrucosa, L. urceolaria, L. mutabilis* (Ach.) Nyl. *non* Sommerf., *Aspicilia mutabilis*. Thomson (1979, 1997), Brodo et al. (2001).

Melanelia

- ***disjuncta*** (Erichsen) Essl. Syn. *Parmelia disjuncta*. Hale (1979), Brodo et al. (2001).
- ***elegantula*** (Zahlbr.) Essl. Syn. *Parmelia elegantula*. Marsh & Nash (1979), Brodo et al. (2001).
- ***exasperata*** (De Not.) Essl. Syns. *Parmelia aspera, P. olivacea* var. *aspidota*.
- ***exasperatula*** (Nyl.) Essl. Syn. *Parmelia exasperatula*. Thomson (1984), Goward et al. (1994a), Brodo et al. (2001).
- ***glabra*** (Schaerer) Essl. Syn. *Parmelia glabra*. May be misidentifications for New Mexico.
- ***hepatizon*** (Ach.) Thell Syn. *Cetraria hepatizon*. Hale (1979).
- ***infumata*** (Nyl.) Essl. Syn. *Parmelia infumata*. Marsh & Nash (1979).
- ***sorediata*** (Ach.) Goward & Ahti Syn. *Parmelia sorediata*
- ***stygia*** (L.) Essl. Brodo et al. (2001), Tucker (2001).
- ***subargentifera*** (Nyl.) Essl. Syn. *Parmelia subargentifera*. Hale (1979), Brodo et al. (2001).
- ***subaurifera*** (Nyl.) Essl. Syn. *Parmelia subaurifera*. Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
- ***subolivacea*** (Nyl.) Essl. Syns. *Parmelia subolivacea, Parmelia olivacea* - probably for New Mexico reports. Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).
- ***tominii*** (Oksner) Essl. Syns. *Parmelia saximontana, P. substygia*. Marsh & Nash (1979), Hale (1979), Thomson (1979), Goward et al. (1994a), Brodo et al. (2001).

Mobergia

- ***angelica*** (Stizenb.) H. Mayrh. & Sheard Syn. *Rinodina angelica*

Mycobilimbia

- ***berengeriana*** (A. Massal.) Hafellner & V. Wirth Syn. *Lecidea berengeriana*
- ***hypnorum*** (Lib.) Kalb. & Hafellner Syn. *Lecidea sanguineoatra*. Synonymy uncertain.
- ***lobulata*** (Sommerf.) Hafellner Syn. *Toninia lobulata*

Mycocalicium

- ***subtile*** (Pers.) Szat. – MIN, NY

Neofuscelia

- ***atticoides*** (Essl.) Essl. Hale (1979), Brodo et al. (2001).

Nephroma

- ***bellum*** (Sprengel) Tuck. Hale (1979), Brodo et al. (2001).
- ***helveticum*** Ach. Syn. *Nephromium helveticum*. Hale (1979), Brodo et al. (2001).
- ***parile*** (Ach.) Ach. Syn. *Nephromium parile*. Hale (1979), Brodo et al. (2001).
- ***resupinatum*** (L.) Ach. Hale (1979).

Normandina

- ***pulchella*** (Borrer) Nyl. Goward et al. (1994a), Brodo et al. (2001).

Ochrolechia

- ***africana*** Vainio Brodo et al. (2001).
- ***androgyna*** (Hoffm.) Arnold – MIN
- ***frigida*** (Sw.) Lynge Brodo et al. (2001).
- ***subisidiata*** Brodo – OMA
- ***upsaliensis*** (L.) A. Massal. Thomson (1979, 1997), Brodo et al. (2001).

Omphalora

arizonica (Tuck. *ex* Willey) T. Nash & Hafellner Syns. *Parmelia arizonica*, *Lecanora arizonica*, *Omphalodium arizonicum*. Egan (1972), Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).

Pannaria

conoplea (Ach.) Bory Syns. *P. rubiginosa* var. *conoplea*, *P. pityrea*. Hale (1979), Jørgensen (2000), Brodo et al. (2001).

rubiginosa (Ach.) Bory Goward et al. (1994a), Brodo et al. (2001).

tavaresii P. M. Jørg. Hale (1979), Brodo et al. (2001).

Parmelia

fraudans (Nyl.) Nyl. Thomson (1984).

saxatilis (L.) Ach. Hale (1979).

sulcata Taylor Brodo et al. (2001).

Parmeliella

triptophylla (Ach.) Müll. Arg. Brodo et al. (2001).

Parmelinopsis

horrescens (Taylor) Elix & Hale Syn. *Parmelina horrescens*. Hale (1979).

minarum (Vainio) Elix & Hale Brodo et al. (2001).

Parmeliopsis

ambigua (Wulfen) Nyl. Hale (1979), Thomson (1984), Goward et al. (1994a), Brodo et al. (2001).

hyperopta (Ach.) Arnold Hale (1979), Brodo et al. (2001).

Parmotrema

arnoldii (Du Rietz) Hale – MIN

austrosinense (Zahlbr.) Hale Brodo et al. (2001).

chinense (Osbeck) Hale & Ahti Syn. *Parmelia trichotera*

crinitum (Ach.) M. Choisy Syn. *Parmelia crinita*. Brodo et al. (2001).

Paulia

pyrenoides (Nyl.) Henssen Syn. *Thyrea pyrenoides*

Peccania

kansana (Tuck.) Forss.

subnigra (de Lesd.) Wetmore Syn. *Placynthium subnigrum*

Peltigera

aphthosa (L.) Willd. Forman & Dowden (1977), Hale (1979), Thomson (1984), Goward et al. (1994a), Brodo et al. (2001).

canina (L.) Willd. Syns. *P. plittii* var. *macrolobata*, *P. plittii* var. *sandwichensis*. Forman & Dowden (1977), Marsh & Nash (1979), Hale (1979), (Czeczuga & Worthington (1997), Brodo et al. (2001).

collina (Ach.) Schaerer Syns. *P. bouly-de-lesdainii*, *P. mauritzii*, *P. scutata*, *P. scutata* var. *collina*. Hale (1979), Brodo et al. (2001).

didactyla (With.) J. R. Laundon Syns. *P. canina* var. *spuria*, *P. erumpens*, *P. spuria*. Hale (1979), Brodo et al. (2001).

elizabethae Gyelnik – MIN

evansiana Gyelink – MIN

horizontalis (Hudson) Baumg. Hale (1979), McCune & Goward (1995), Brodo et al. (2001).

lepidophora (Vainio) Bitter Brodo et al. (2001).

leucophlebia (Nyl.) Gyelnik Syns. *P. aphthosa* var. *variolosa*, *P. variolosa*, *P. aphthosa* var. *leucophlebia*. Brodo et al. (2001).
malacea (Ach.) Funck Brodo et al. (2001).
neckeri Hepp *ex* Müll. Arg. – MIN
polydactylon (Necker) Hoffm. Syns. *P. dolichorrhiza*, *P. polydactyla*, *P. polydactyloides* var. *imbricatoides*. Hale (1979), Brodo et al. (2001), Tucker (2001).
ponojensis Gyelnik Brodo et al. (2001).
praetextata (Flörke *ex* Sommerf.) Zopf Czeczuga & Worthington (1997), St. Clair (1999), Brodo et al. (2001).
rufescens (Weiss) Humb. Syns. *P. canina* f. *incusa*, *P. canina* var. *rufescens*, *P. canina* f. *subchagrinosa*, *P. plittii* f. *ornata*, *P. plittii* f. *suffusa*.
venosa (L.) Hoffm. Forman & Dowden (1977), Thomson (1979), Hale (1979), McCune & Goward (1995), Brodo et al. (2001).

Peltula
bolanderi (Tuck.) Wetmore Marsh & Nash (1979).
euploca (Ach.) Poelt Syns. *Heppia guepinii*, *H. polyphylla*. Nash et al. (1977), Czeczuga & Worthington (1997), Brodo et al. (2001).
obscurans (Nyl.) Gyelnik var. ***obscurans***, var. ***deserticola*** (Zahlbr.) Wetmore, var. ***hassei*** (Zahlbr.) Wetmore. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
patellata (Bagl.) Swinscow & Krog Syn. *P. polyspora*. Nash et al. (1977).
richardsii (Herre) Wetmore Syn. *Heppia richardsii*. Brodo et al. (2001).

Pertusaria
albescens (Hudson) M. Choisy & Werner Lumbsch et al. (1999).
amara (Ach.) Nyl. Lumbsch et al. (1999).
azulensis de Lesd. Lumbsch et al. (1999).
consocians Dibben Lumbsch et al. (1999).
ophthalmiza (Nyl.) Nyl. Lumbsch et al. (1999), Brodo et al. (2001).
saximontana Wetmore Marsh & Nash (1979), Lumbsch et al. (1999).
sommerfeltii (Flörke) Fr. Lumbsch et al. (1999).
tejocotensis de Lesd. Lumbsch et al. (1999).
wulfenoides de Lesd. Lumbsch et al. (1999).

Phacopsis
thallicola (A. Massal.) Triebel & Rambold Triebel et al. (1995).

Phaeophyscia
cernohorskyi (Nádv.) Essl. Hale (1979), McCune & Goward (1995), Brodo et al. (2001).
ciliata (Hoffm.) Moberg Syn. *Physcia obscura*. Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
constipata (Norrlin & Nyl.) Moberg Syn. *Physcia constipata*. Czeczuga & Worthington (1997).
decolor (Kashiw.) Essl. Hale (1979).
endococcina (Körber) Moberg Syn. *Physcia endococcina*, *P. lithotodes*. Marsh & Nash (1979), Thomson (1984).
hirsuta (Mereschk.) Essl. – MIN
hispidula (Ach.) Essl. Syns. *Physcia setosa*, *P. hispidula*. Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).
nigricans (Flörke) Moberg Syn. *Physcia nigricans*

orbicularis (Necker) Moberg Syn. *Physcia orbicularis*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
sciastra (Ach.) Moberg Hale (1979), Brodo et al. (2001).

Phaeorrhiza
nimbosa (Fr.) H. Mayrh. & Poelt Syns. *Rinodina phaeocarpa*, *R. nimbosa*. Mayrhofer & Poelt (1978), Thomson (1979, 1997), Brodo et al. (2001).

Physcia
adscendens (Fr.) H. Olivier Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
aipolia (Ehrh. *ex* Humb.) Fürnr. Syn. *P. stellaris* var. *aipolia*. Hale (1979), Marsh & Nash (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).
albinea (Ach.) Nyl.
biziana (A. Massal.) Zahlbr. Marsh & Nash (1979), Hale (1979).
caesia (Hoffm.) Fürnr. Nash et al. (1977), Marsh & Nash (1979), Thomson (1979), Hale (1979).
callosa Nyl. Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997).
cascadensis H. Magn. Marsh & Nash (1979), McCune & Goward (1995).
dubia (Hoffm.) Lettau Syn. *P. intermedia*. Marsh & Nash (1979), Thomson (1979), Hale (1979), Brodo et al. (2001).
halei J. W. Thomson Nash et al. (1977), Marsh & Nash (1979), Hale (1979).
leptalea (Ach.) DC. Syns. *P. adscendens* var. *leptalea*, *P. semipinnata*. Goward et al. (1994a).
mexicana de Lesd. – MIN
montana de Lesd.
phaea (Tuck.) J. W. Thomson Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
stellaris (L.) Nyl. Nash et al. (1977), Marsh & Nash (1979), Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).
subtilis Degel. Hale (1979).
tenella (Scop.) DC. Brodo et al. (2001).
tribacia (Ach.) Nyl.
wainioi Räsänen Marsh & Nash (1979).

Physciella
nepalensis (Poelt) Essl. – OMA

Physconia
detersa (Nyl.) Poelt Syn. *Physcia grisea* f. *detersa*. Brodo et al. (2001).
elegantula Essl. Esslinger (1994), Brodo et al. (2001).
enteroxantha (Nyl.) Poelt Czeczuga & Worthington (1997), Brodo et al. (2001).
leucoleiptes (Tuck.) Essl. Syn. *Physcia pulverulenta* var. *leucoleiptes*
muscigena (Ach.) Poelt Nash et al. (1977), Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
perisidiosa (Erichsen) Moberg Brodo et al. (2001).
thomsonii Essl. Brodo et al. (2001).

Physma
cataractaecola de Lesd.

Placidium
acarosporoides (Zahlbr.) Breuss Syns. *Endopyrenium novomexicanum*, *Endocarpon bajadanae*, *Catapyrenium acarosporoides*, *Dermatocarpon acarosporoides*. Marsh & Nash (1979), Thomson (1987, 1989), Brodo et al. (2001).

lachneum (Ach.) Breuss Syns. *Placidium hepaticum*, and var. *pruinosum*, var. *reticulatum*, *Endopyrenium lachneum*, *Catapyrenium lachneum*, *Dermatocarpon lachneum*. Nash et al. (1977), Marsh & Nash (1979), Thomson (1987).
lacinulatum (Ach.) Breuss Brodo et al. (2001).
pilosellum (Breuss) Breuss – OMA
rufescens (Ach.) Breuss Syn. *Dermatocarpon rufescens*.
squamulosum (Ach.) Breuss – NY
tuckermanii (Ravenel *ex* Mont.) Breuss Syn. *Dermatocarpon tuckermanii*. Marsh & Nash (1979).

Placynthium
nigrum (Hudson) Gray Hale (1979), Brodo et al. (2001).

Pleopsidium
chlorophanum (Wahlenb.) Zopf Syns. *Acarospora chlorophana*, *A. erythrophora*, *A. incertula*, *A. novomexicana*, *Lecanora chlorophana*. Nash et al. (1977), Marsh & Nash (1979).
flavum (Bellardi) Körber Syn. *Acarospora oxytona*. Hafellner (1993).

Polychidium
muscicola (Sw.) Gray Brodo et al. (2001).

Polysporina
simplex (Davies) Vězda Syn. *Sarcogyne simplex*

Protoblastenia
rupestris (Scop.) J. Steiner Thomson (1997), Brodo et al. (2001).

Protopannaria
pezizoides (Weber) P. M. Jørg. & S. Ekman Syn. *Pannaria pezizoides*. Thomson (1979), Goward et al. (1994a), Jørgensen (2000), Brodo et al. (2001).

Protoparmelia
badia (Hoffm.) Hafellner Syn. *Lecanora badia*. Thomson (1979), Brodo et al. (2001).

Pseudephebe
minuscula (Nyl. *ex* Arnold) Brodo & D. Hawksw. Syn. *Alectoria minuscula*. Brodo & Hawksworth (1977), McCune & Goward (1995), Goward (1999), Brodo et al. (2001).
pubescens (L.) M. Choisy Syn. *Alectoria pubescens*. Thomson (1979), Hale (1979).

Pseudevernia
consocians (Vainio) Hale & Culb.
intensa (Nyl.) Hale & Culb. Syns. *Evernia furfuracea* for New Mexico records, *Parmelia furfuracea* var. *intensa*. Hale (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).

Psora
cerebriformis W. A. Weber Timdal (1986), Goward et al. (1994a), McCune & Goward (1995), Brodo et al. (2001).
crenata (Taylor) Reinke Syns. *P. coroniformis*, *Lecidea crenata*. Timdal (1986), Brodo et al. (2001).
decipiens (Hedwig) Hoffm. Syn. *Lecidea decipiens*. Marsh & Nash (1979), Thomson (1979), Hale (1979), Timdal (1986), Brodo et al. (2001).
globifera (Ach.) A. Massal. Syn. *Lecidea globifera*. Timdal (1986), Goward et al. (1994a), Marsh & Nash (1979), Brodo et al. (2001).
himalayana (Chruch. Bab.) Timdal – MIN
icterica (Mont.) Müll. Arg. Timdal (1986), Brodo et al. (2001).
luridella (Tuck.) Fink Syn. *Biatora luridella*, *Lecidea luridella*. Timdal (1986).

nipponica (Zahlbr.) Gotth. Schneider Syns. *P. novomexicana*, *Lecidea novomexicana.* Hale (1979), Timdal (1986), Thomson (1997), Brodo et al. (2001).

pseudorussellii Timdal Brodo et al. (2001).

rubiformis (Ach.) Hook. Syn. *Lecidea rubiformis.* Thomson (1979).

russellii (Tuck.) A. Schneider Syn. *Lecidea russellii.* Marsh & Nash (1979).

tuckermanii R. Anderson *ex* Timdal Timdal (1986), Goward et al. (1994a), Brodo et al. (2001).

Psoroma

hypnorum (Vahl) Gray Thomson (1979), Hale (1979), Goward et al. (1994a), Brodo et al. (2001).

Psorula

rufonigra (Tuck.) Gotth. Schneider Syn. *Psora brouardii.* Brodo et al. (2001).

Punctelia

bolliana (Müll. Arg.) Krog Syn. *Parmelia bolliana.* Nash et al. (1977), Hale (1979).

borreri (Sm.) Krog Syn. *Parmelia borreri*

hypoleucites (Nyl.) Krog Syns. *Parmelia bolliana* Chem. Strain 1, *P. hypoleucites.* Marsh & Nash (1979), Czeczuga & Worthington (1997), Brodo et al. (2001).

rudecta (Ach.) Krog Syn. *Parmelia rudecta.* Hale (1979).

semansiana (Culb. & C. Culb.) Krog Syn. *Parmelia semansiana.* Culberson & Culberson (1980).

stictica (Duby) Krog Syn. *Parmelia stictica.* Brodo et al. (2001).

subrudecta (Nyl.) Krog Syns. *Parmelia graminicola*, *P. subrudecta.* Hale (1979), St. Clair (1999), Brodo et al. (2001).

ulophylla (Ach.) van Herk & Aptroot Syn. *Parmelia borreri* var. *ulophylla. Punctelia ulophylla* was recently recognized as separate from *P. subrudecta* in Europe (van Herk & Aptroot, 2000).

Pyrenocollema

halodytes (Nyl.) R. C. Harris Syn. *Arthopyrenia halodytes*

Ramalina

americana Hale Syns. *R. fastigata* for earlier New Mexico reports, *R. populina* probably for early record. Czeczuga & Worthington (1997).

celastri (Sprengel) Krog & Swinscow Syns. *Ramalina yemensis* and *Ramalina laevigata* (probably).

complanata (Sw.) Ach. Brodo et al. (2001).

dilacerata (Hoffm.) Hoffm. Goward (1999).

farinacea (L.) Ach. Goward (1999).

fraxinea (L.) Ach. Syn. *R. calcicaris* var. *fraxinea*

intermedia (Delise *ex* Nyl.) Nyl. Bowler & Rundel (1974), Hale (1979), Thomson (1984), Goward (1999), Brodo et al. (2001).

obtusata (Arnold) Bitter Brodo et al. (2001).

pollinaria (Westr.) Ach. Hale (1979), Goward (1999), Czeczuga & Worthington (1997), Brodo et al. (2001).

polymorpha (Lilj.) Ach.

roesleri (Hochst. *ex* Schaerer) Hue Syn. *R. pollinariella.* Goward (1999).

sinensis Jatta Marsh & Nash (1979), Czeczuga & Worthington (1997), St. Clair (1999), Goward (1999), Tucker (2001), Brodo et al. (2001).

tenuis (Tuck.) G. Merr.

Rhizocarpon

- ***disporum*** (Nägeli *ex* Hepp) Müll. Arg. Syn. *Rhizocarpon concretum* f. *montagnei*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
- ***geographicum*** (L.) DC. Czeczuga & Worthington (1997), Brodo et al. (2001).
- ***macrosporum*** Räsänen Brodo et al. (2001).
- ***polycarpum*** (Hepp) Th. Fr.
- ***riparium*** Räsänen Marsh & Nash (1979).
- ***superficiale*** (Schaerer) Vainio

Rhizoplaca

- ***chrysoleuca*** (Sm.) Zopf Syns. *Parmularia rubina*, *Lecanora rubina*, *L. chrysoleuca*. Nash (1976), Marsh & Nash (1979), Hale (1979), McCune (1987), Brodo et al. (2001).
- ***melanophthalma*** (DC.) Leuckert & Poelt Syns. *Parmularia melanophthalma*, *Lecanora melanophthalma*, *L. rubina* var. *opaca*, *Lecidea brandegei* - synonymy uncertain. Marsh & Nash (1979), Nash & Sommerfield (1981), McCune (1987), Brodo et al. (2001).
- ***peltata*** (Ramond) Leuckert & Poelt Syn. *Lecanora rubina* var. *heteromorpha*. McCune (1987).
- ***subdiscrepans*** (Nyl.) R. Sant. Brodo et al. (2001).

Rimelia

- ***reticulata*** (Taylor) Hale & Fletcher Syns. *Parmelia reticulata*, *Parmotrema reticulatum*. Nash et al. (1977), Hale (1979).

Rimularia

- ***insularis*** (Nyl.) Rambold & Hertel Syn. *Lecidea insularis*

Rinodina

- ***americana*** de Lesd.
- ***archaea*** (Ach.) Arnold Marsh & Nash (1979).
- ***bischoffii*** (Hepp) A. Massal. Marsh & Nash (1979).
- ***brouardii*** de Lesd.
- ***calcarea*** Arnold Marsh & Nash (1979). Not listed in the Esslinger (2001).
- ***exigua*** (Ach.) Gray Marsh & Nash (1979).
- ***intermedia*** Bagel Mayrhofer et al. (2001).
- ***laevigata*** (Ach.) Malme
- ***lecanoides*** de Lesd.
- ***lycopodiicola*** de Lesd.
- ***milvina*** (Wahlenb.) Th. Fr. Thomson (1979).
- ***minutissima*** de Lesd.
- ***mniaraea*** (Ach.) Körber
- ***mucronatula*** H. Magn. – MIN
- ***olivaceobrunnea*** C. W. Dodge & Baker Syn. *R. archeoides*
- ***silicicola*** de Lesd.
- ***vegasii*** de Lesd.

Sarcogyne

- ***integra*** (de Lesd.) H. Magn. Syn. *Biatorella integra*
- ***magnussonii*** de Lesd. Syn. *Biatorella magnussonii*
- ***novomexicana*** H. Magn.
- ***privigna*** (Ach.) A. Massal. Marsh & Nash (1979), Thomson (1997).

regularis Körber Syn. *Sarcogyne pruinosa*. Czeczuga & Worthington (1997), Brodo et al. (2001).

Schaereria

fuscocinerea (Nyl.) Clauzade & Roux Syns. *Lecidea griseoatra*, *L. tenebrosa*

Solorina

bispora Nyl. Goward et al. (1994a).

crocea (L.) Ach. Hale (1979), Thomson (1979, 1984), Goward et al. (1994a), McCune & Goward (1995), St. Clair (1999), Brodo et al. (2001).

octospora (Arnold) Arnold Thomson (1979, 1984), Goward et al. (1994a), McCune & Goward (1995).

saccata (L.) Ach. Hale (1979).

spongiosa (Ach.) Anzi Syn. *S. saccata* var. *spongiosa*. Goward et al. (1994a), Tucker (2001), Brodo et al. (2001).

Speerschneidera

euploca (Tuck.) Trevisan – OMA

Spilonema

revertens Nyl. Goward (1999), Brodo et al. (2001).

Sporastatia

polyspora (Nyl.) Grummann Syn. *S. cinerea*. Goward et al. (1996).

testudinea (Ach.) A. Massal. Brodo et al. (2001).

Squamarina

lentigera (Weber) Poelt Hale (1979), Brodo et al. (2001).

Staurothele

areolata (Ach.) Lettau Thomson (1991).

drummondii (Tuck.) Tuck. Syns. *S. clopima*, *S. ambrosiana* for North American records, *Endocarpon wilmsoides*. Marsh & Nash (1979), Thomson (1991), Czeczuga & Worthington (1997), Brodo et al. (2001).

elenkinii Oksner Syn. *S. rufa* - for North American records. Marsh & Nash (1979), Thomson (1991).

fissa (Taylor) Zwackh Syn. *S. umbrina*

lecideoides de Lesd. Thomson (1991).

monicae (Zahlbr.) Wetmore Syn: *S. catalepta*. Marsh & Nash (1979), Thomson (1991).

polygonia de Lesd. Thomson (1991).

Stenocybe

fragmenta E. B. Peterson & Rikkinen Peterson & Rikkinen (1998).

pullatula (Ach.) Stein – NY

Stereocaulon

tomentosum Fr. Lobaric acid strain - McCune & Goward (1995), Tucker (2001), Brodo et al. (2001).

myriocarpum Th. Fr. McCune & Goward (1995).

Sticta

fuliginosa (Hoffm.) Ach. Brodo et al. (2001).

sylvatica (Hudson) Ach.

Stigmidium

peltideae (Vainio) R. Sant. – NY

Teloschistes

chrysophthalmus (L.) Th. Fr.

contortuplicatus (Ach.) Clauzade & Rondon *ex* Vězda Goward (1999).

flavicans (Sw.) Norman Syn. *Teloschistes chrysophthalmus* var. *puberus*

Tephromela

armeniaca (DC.) Hertel & Rambold Syn. *Lecidea armeniaca*. Thomson (1979, 1997), St. Clair (1999), Brodo et al. (2001).

atra (Hudson) Hafellner Syn. *Lecanora atra*. Marsh & Nash (1979), Brodo et al. (2001).

Thamnolia

subuliformis (Ehrh.) Culb. St. Clair (1999), Wright (1992).

Thrombium

epigaeum (Pers.) Wallr. – NY

Thyrea

confusa Henssen – OMA

Toninia

aleutacea (Anzi) Jatta Timdal (1991), Brodo et al. (2001).

aromatica (Sm.) A. Massal. – MIN

candida (Weber) Th. Fr. Syn. *Thalloedoema candida*. Marsh & Nash (1979), Goward et al. (1994), Timdal (1991).

cinereovirens (Schrader) A. Massal. Marsh & Nash (1979).

lutosa (Ach.) Timdal Timdal (1991).

massata (Tuck.) Herre Timdal (1991).

philippea (Mont.) Timdal Syn. *Catillaria kansuensis*. Marsh & Nash (1979), Timdal (1991).

ruginosa (Tuck.) Herre

sedifolia (Scop.) Timdal Syn. *T. coeruleonigricans*. Marsh & Nash (1979), Thomson (1979), Timdal (1991), Brodo et al. (2001).

subdiffracta Timdal Timdal (1991).

tristis (Th. Fr.) Th. Fr. subsp. ***asiae-centralis*** (H. Magn.) Timdal, subsp. ***scholanderi*** (Lynge) Timdal. Thomson (1979), Timdal (1991), Goward et al. (1994), Brodo et al. (2001).

verrucarioides (Nyl.) Timdal Timdal (1991).

weberi Timdal Timdal (1991).

Trapeliopsis

flexuosa (Fr.) Coppins & P. James Brodo et al. (2001).

granulosa (Hoffm.) Lumbsch Syn. *Lecidea granulosa*. Marsh & Nash (1979), Brodo et al. (2001).

Tremolecia

atrata (Ach.) Hertel Syns. *Lecidea dicksonii*, *L. atrata*. Thomson (1979), Brodo et al. (2001).

Tuckermannopsis

chlorophylla (Willd.) Hale Syn. *Cetraria chlorophylla*

coralligera (W. A. Weber) W. A. Weber Syn. *Cetraria coralligera*. Hale (1979), Brodo et al. (2001).

fendleri (Nyl.) Hale Syns. *Cetraria fendleri*, *Parmelia fendleri*. Hale (1979), McCune & Goward (1995), Brodo et al. (2001).

Umbilicaria

americana Poelt & T. H. Nash Poelt & Nash (1993), Brodo et al. (2001).

cinereorufescens (Schaerer) Frey Czeczuga & Worthington (1997).

decussata (Vill.) Zahlbr. Syn. *Omphalodiscus decussatus*. Czeczuga & Worthington (1997), St. Clair (1999), Brodo et al. (2001).
hyperborea (Ach.) Hoffm. Syns. *Gyrophora hyperborea*, *G. intermedia*. Hale (1979), Brodo et al. (2001).
krascheninnikovii (Savicz) Zahlbr. Syn. *Omphalodiscus krascheninnikovii*. Hale (1979), St. Clair (1999), Brodo et al. (2001).
phaea Tuck. Hale (1979).
torrefacta (Lightf.) Schrader Syn. *Gyrophora torrefacta*. Marsh & Nash (1979), Hale (1979).
vellea (L.) Hoffm. Syn. *Gyrophora vellea*. Hale (1979). Most New Mexico records are probably *U. americana*.
virginis Schaerer Syn. *Omphalodiscus virginis*. Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).

Usnea
affinis Mot.
ambyloclada (Müll. Arg.) Zahlbr. Clerc & Herrera-Campos (1997), Brodo et al. (2001).
arizonica Mot. Hale (1979), Tavares & Sanders (1998), Brodo et al. (2001).
cavernosa Tuck. Hale (1979), St. Clair (1999), Goward (1999), Brodo et al. (2001).
ceratina Ach. Hale (1979), Goward (1999).
ciliifera Mot. Probably refers to *U. cirrosa* (Tavares & Sanders, 1998).
cirrosa Mot. Tavares & Sanders (1998), St. Clair (1999), Brodo et al. (2001).
cornuta Körber Brodo et al. (2001), Tucker (2001).
erinacea Vainio
filipendula Stirton Syn. *U. dasypoga*. Hale (1979), Goward (1999).
florida (L.) F. H. Wigg. Syn. *U. barbata* var. *florida*
fragillescens var. **mollis** (Vainio) Clerc Syn. *U. mollis*. Goward (1999).
fulvoreagens (Räsänen) Räsänen Hale (1979).
glabrata (Ach.) Vainio Syn. *U. sorediifera* (Arnold) Lynge. Marsh & Nash (1979), Goward (1999).
glabrescens (Nyl. *ex* Vainio) Vainio Syn. *U. compacta*
hirta (L.) F. H. Wigg. Syn. *U. variolosa*. Marsh & Nash (1979), Hale (1979), St. Clair (1999), Goward (1999), Brodo et al. (2001).
lapponica Vainio Syn. *U. sorediifera* sensu Mot. Goward (1999), Czeczuga & Worthington (1997).
merrillii Mot.
monstruosa Vainio
retifera Mot.
scabiosa Mot.
strigosa (Ach.) Eaton Syn. *U. florida* var. *strigosa*
subfloridana Stirton Syns. *U. comosa*, *U. comosa* subsp. *eucomosa*. Hale (1979), Marsh & Nash (1979), Goward (1999).
sylvatica Mot.
tristis Mot. Fiscus (1972).

Verrucaria
baldensis Massal. – NY
caerulea DC. Syn. *Verrucaria glaucina*
calciseda DC.

cetera Breuss Breuss (1998).
fuscella (Turner) Winch
inficiens Breuss Syns. *Endopyrenium plumbeum*, *Catapyrenium plumbeum*, *Dermatocarpon plumbeum*. Nash et al. (1977), Marsh & Nash (1979), Thomson (1987), Breuss (1998).
margacea (Wahlenb.) Wahlenb. – NY
marmorea (Scop.) Arnold Syn. *Verrucaria marmorea* var. *inornata*
muralis Ach.
novomexicana de Lesd.
sphinctrinella Zschacke Marsh & Nash (1979) but not in Esslinger (2001).
subglaucina de Lesd.

Vulpicida
pinastri (Scop.) J.-E. Mattsson & M. J. Lai Syn. *Cetraria pinastri*. Hale (1979), Thomson (1979), Mattsson (1993), Goward et al. (1994a), St. Clair (1999), Brodo et al. (2001).
tilesii (Ach.) J.-E. Marttsson & M. J. Lai Syn. *Cetraria tilesii*. Thomson (1984), Mattsson (1993), Goward et al. (1994a), McCune & Goward (1995), St. Clair (1999), Brodo et al. (2001).

Xanthoparmelia
ajoensis (T. Nash) Egan Egan (1975), Culberson et al. (1979).
angustiphylla (Gyelnik) Hale Syn. *X. hypopsila* for North American records. Hale (1979).
australasica D. J. Galloway – OMA
chlorochroa (Tuck.) Hale Syns. *Parmelia molliuscula* for New Mexico reports, *Parmelia chlorochroa*. Hale (1979), Marsh & Nash (1979), Thomson (1984), Brodo et al. (2001).
coloradoensis (Gyelnik) Hale Syns. *Parmelia ioannis-simae*, *P. stenophylla*, and *Parmelia taractica*, *Xanthoparmelia taractica* for New Mexico records. Hale (1979).
conspersa (Ehrh. *ex* Ach.) Hale Syn. *Parmelia conspersa*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
cumberlandia (Gyelnik) Hale Syns. *Parmelia conspersa* Chem. Strain 1, *P. cumberlandia*. Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).
dierythra (Hale) Hale Syn. *Parmelia dierythra*. Marsh & Nash (1979), Nash (1974); however, records are probably *X. maricopensis*.
dissensa (T. Nash) Hale Syn. *Paremlia dissensa*. Nash (1974), Nash et al. (1977).
joranadia (T. Nash) Hale Syn. *Parmelia joranadia*. Nash (1974).
lavicola (Gyelnik) Hale Syn. *Parmelia kurokawae*. Marsh & Nash (1979)., Brodo et al. (2001).
lineola (E. C. Berry) Hale Syns. *Parmelia lineola*, *P. conspersa* Chem. Strain 2. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
maricopensis T. Nash & Elix - MIN (paratype). See note under *X. dierythra*.
mexicana (Gyelnik) Hale Syn. *Parmelia mexicana*. Nash et al. (1977), Marsh & Nash (1979), Brodo et al. (2001).
neoconspersa (Gyelnik) Hale Goward et al. (1996).
novomexicana (Gylenik) Hale Syns. *Parmelia novomexicana*, *P. arseneana*, *P. conspersa* Chem. Strain 3. Nash et al. (1977), Hale (1979), Marsh & Nash (1979), Brodo et al. (2001).

plittii (Gyelnik) Hale Syn. *Parmelia plittii.* Marsh & Nash (1979), Hale (1979), Brodo et al. (2001).

psoromifera (Kurok.) Hale Syn. *Parmelia psoromifera.* Egan (1975), Nash et al. (1977), Marsh & Nash (1979).

subdecipiens (Vainio) Hale Syn. *Parmelia subdecipiens.* Marsh & Nash (1979).

subramigera (Gyelnik) Hale Hale (1979).

tasmanica (Hook. f. & Taylor) Hale Syns. *Parmelia pulvinaris* var. *lacinulata, Parmelia tasmanica.* Nash (1974).

weberi (Hale) Hale Brodo et al. (2001).

wyomingica (Gyelnik) Hale Egan (1975), Goward et al. (1994a), Brodo et al. (2001).

Xanthoria

candelaria (L.) Th. Fr. Syns. *Physcia parietina* var. *lychnea, Teloschistes parietinus* var. *lychneus.* Hale (1979), Goward et al. (1994a), but not reported from New Mexico in Lindblom (1997).

elegans (Link) Th. Fr. Syns. *Placodium elegans, Caloplaca elegans.* Hale (1979), Marsh & Nash (1979), Czeczuga & Worthington (1997), Lindblom (1997).

fallax (Hepp) Arn. Nash et al. (1977), Hale (1979), Marsh & Nash (1979), Goward et al. (1994a), Czeczuga & Worthington (1997), Lindblom (1997), Brodo et al. (2001).

hasseana Räsänen – MIN

montana L. Lindblom Lindblom (1997). Most reports of *X. polycarpa* probably belong here.

oregana Gyelnik Lindblom (1997).

polycarpa (Hoffm.) Rieber Syns. *Teloschistes parietinus* var. *polycarpus, T. polycarpus, Physcia parietina* var. *polycarpa.* Marsh & Nash (1979), Hale (1979), Goward et al. (1994a), Czeczuga & Worthington (1997), but not reported from New Mexico by Lindblom (1997). See note under *X. montana.*

sorediata (Vainio) Poelt Syns. *Placodium elegans var. compactum, Caloplaca sorediata.* Hale (1979), Brodo et al. (2001).

ulophyllodes Räsänen Lindblom (1997). New Mexico reports of *X. candelaria* may belong here. Brodo et al. (2001).

Xylographa

parallela (Ach.:Fr.) Behlen & Desberger Brodo et al. (2001).

vitiligo (Ach.) Laundon – NY

Reports of Uncertain Identity

Anaptychia wrightii – Fink (1935).

Aspicilia calcarea – Syn. *Lecanora calcarea.* Nash et. al. (1977), Marsh & Nash (1979). Most North American records are probably *A. contorta* (fide Wetmore).

Caloplaca caesiorufa – Removed as a *nomenum confusum.*

Caloplaca diphyodes – Marsh & Nash (1979). Not in North America.

Cladonia foliacea – Misidentifications for North America.

Cladonia subcariosa – Excluded from New Mexico.

Cladonia subcervicornis – Misidentifications for North America.

Collema granuliferum ?

Gyrophora cirrhosa – Misidentification for New Mexico.

Lecanora pallida – Records are *L. caesiorubella* subsp. *saximontana* or *L. carpinea.*

Lecidella spp. – Various Syns. *Lecidea enteroleuca, Lecidea subauriculata, L. parasema.* Records are probably *Lecidella euphorea* or *L. elaeochroma.*

Leptogium hildenbrandii – Misidentifications for North America.

Leptogium menziesii – Misidentifications for North America.

Leptogium palmatum is *L. corniculatum* but misidentification for New Mexico.
Leptogium tremelloides – Misidentifications for North America.
Nephromium laevigatum is *Nephroma laevigatum* but probably not in New Mexico.
Nephromium resupinatum is *Nephroma resupinatum* but probably not in New Mexico.
Ochrolechia pallescens – Misidentifications for North America.
Parmelia delisei is *Neofuscelia delisei* but not recognized from North America.
Parmelia furfuracea – New Mexico records are *Pseudevernia intensa* or *P. consocians.*
Parmelia isidiata Chem. Strain 1 is either *Xanthoparmelia conspersa* or *X. plittii.*
Parmelia prolixa is *Neofuscelia pulla* but not in North America.
Parmelia tinctina – Nash (1974) but not in North America (Nash et al., 1977).
Peltula clavata – Erroneous map record.
Physcia alba – Marsh & Nash (1979), but misidentificaitons for North America.
Physcia grisea is *Physconia grisea* but misidentifications for North America.
Physcia pulverulenta – Hale (1979). Misidentifications for North America.
Physconia grisea – Marsh & Nash (1979). Misidentifications for North America.
Pseudevernia furfuracea – Not in North America. Probably *P. intensa* or *P. consocians.*
Psora americana – Identity uncertain.
Pyrenula nitida – Misidentifications for North America.
Ramalina fraxinea var. *subampliata* – Misidentifications for North America.
Ramalina subampliata – Misidentifications for North America.
Rinodina roboris – Misidentifications for North America.
Rinodina sophodes – Misidentificaitons for North America.
Sticta weigelii – Hale (1979). Misidentifications for North America.
Teloschistes parietinus is *Xanthoria parietina* but probable misidentification for New Mexico.
Thamnolia vermicularis – Goward (1999). Records are *T. subuliformis* for New Mexico.
Thelidiella blastenicola is a non-lichenized fungus.
Toninia cummulata – Misidentifications for North America.
Umbilicaria pustulata – Probable misidentifications.
Usnea comosa var. *erosula* – A *nomenum nudum.*
Usnea dasypoga var. *plicata* – Misidentifications for North America.
Usnea intermedia – Misidentifications for North America.
Usnea perplectans – An Asian species not in North America.
Usnea rigida – Goward (1999), but New Mexico reference is probably *U. arizonica.*
Usnea scabrata – Goward (1999). New Mexico reference probably refers to *U. scabiosa.*
Xanthoparmelia taractica – New Mexico records are probably *X. coloradoensis.*
Xanthoria parietina is a probable misidentification for New Mexico.

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A new, northern location for the liverwort *Telaranea nematodes* (Gottsche ex Austin) M. A. Howe

Mary S. G. Lincoln[1] and Scott LaGreca[2]

Martha's Vineyard is an island off the coast of Massachusetts, just south of Falmouth on the elbow of Cape Cod. On a recent field expedition, the second author collected a few bryophytes and brought them to the first author for identification. Among these was a specimen of *Telaranea nematodes* (Gottsche ex Austin) M. A. Howe.

Telaranea Spruce ex. Schiffn. is a genus of 33 largely tropical and antipodal species, only one of which occurs in North America. *Telaranea nematodes* is an unusual liverwort heretofore found only from New York south along the Atlantic and mid-Gulf coastal plains (Schuster 1969, Breil 1970, Conard & Redfearn 1979, Hicks 1992). The plants appear as pale green delicate glistening strands creeping along soil or climbing among other bryophytes in coastal swamps. Its leaves consist of 2-4 lobes (2 in weaker plants, 4 in more robust ones), divided to within one or two cells of the base. Each lobe is a single row of about 4-8 thin walled, somewhat inflated cells, with a base of two cells. It is somewhat similar to *Blepharostoma* in appearance but can be distinguished from it by its shiny, nearly transparent appearance, and the deflated look of its cells when dry, its smaller underleaves (similar to but about half the size of the leaves), and the distinctive two-celled base of each leaf lobe (Schuster 1969).

The Martha's Vineyard specimen (*LaGreca 645*) was found quite by accident in a sample of *Sphagnum angermanicum* Melin (*LaGreca 644*) which was collected on October 17, 2001 at the edge of a dried up pond on the top of a cliff about three hundred feet from the seashore on Squibnocket Point in the town of Chilmark. (41°18'19.563"N, 70°46'14.815"W). The plants were sparsely branched and the leaves had mostly only two lobes. Given how far north of its preferred climate it was found it is not surprising that these plants were not particularly robust. Voucher specimens are deposited in the Farlow Herbarium, Cambridge, Massachusetts, and in the herbarium of the New York State Museum, Albany, New York.

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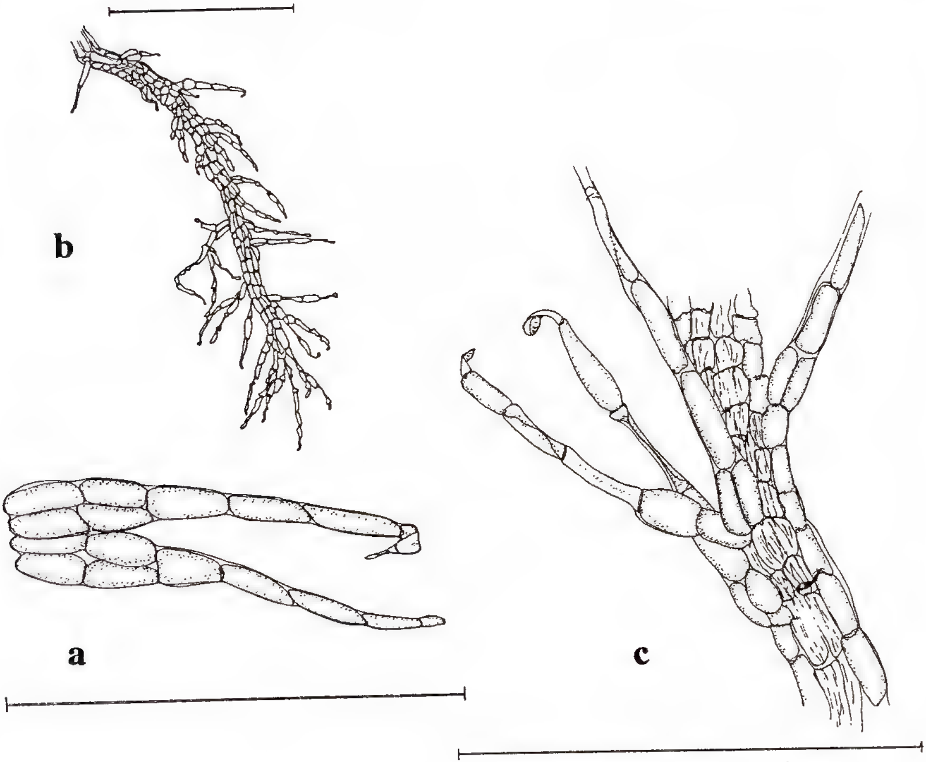

Figure 1. *Telaranea nematodes* **a.** leaf with 2 lobes (scale bar=.5 mm) **b.** shoot scale bar=1 mm) **c.** portion of stem with leaves, showing some cells inflated and some deflated (scale bar=.5 mm). All figures from *LaGreca 645*.

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Colorado Bryological Hot Spots, 2. Mount Evans

William A. Weber & Ronald C. Witmann

Mount Evans is a 14,000 foot granite peak in the Colorado Front Range just west of, and less than an hour's drive, from Denver. It is reached from Interstate I-70 at Idaho Springs. A paved road goes to about a hundred feet from the summit. Two sites, Summit Lake, and the Mount Epaulet Saddle between Summit Lake and the top of the mountain, support the richest assemblage of alpine bryophytes in Colorado. Three peaks dedicated to great American botanists, Gray, Torrey, and Engelmann, are close by; it is fitting that Evans should be famous for its botanical treasures.

The Summit Lake area was designated the first Natural History Landmark in Colorado in 1965 (Weber 1965, 1991). It has the distinction of having been visited by many of the world's most distinguished botanists, bryologists, and plant geographers, including Ove Almborn, Lewis Anderson, D. D. Awasthi, Roland Beschel, Jim Calder, Ann Connolly, Eilif Dahl, Mai-Britt Florin, Kjeld Holmen, Frad Hermann, Eric Hultén, Per Magnus Jörgensen, George Neville Jones, Kuldip Khanna, Vera Komarkova, Timo Koponen, Áskell and Doris Löve, Erling Porsild, Bill Steere, Misao Tatewaki, and Antero Vaarama. The scenic and biologically fascinating upper half of the mountain is protected; rest sites and other small developments are carefully planned, and collecting is done only by permit. Most people drive up to the summit simply to enjoy the views of South Park, Mount Bierstadt, the Front Range, and the Denver Basin. With luck, one can enjoy warm weather with no chilly breezes. But always there is the possibility of high winds, sleet, grapple, hail or snow. Smelling salts are recommended for those who tend to lose consciousness at high altitudes. Whatever the weather, a visit to Mount Evans is a marvelous experience, one to lift the spirit of anyone with a bryological craving.

Summit Lake is the largest lake at such a high altitude (12,800 feet) in the region and lies in a protected northeast niche of the Mount Evans massif. Relatively little sunlight reaches the lake throughout the year. Standing on the shore at most points one cannot see the plains below; there is an eerie feeling not of high altitude but of an Arctic shore. Unlike most cirque lakes that arise at the base of screes, it has an larger than usual inlet area of gentle slopes with meandering and anastomosing streamlets, gravel bars, sedge hummocks, frost-push ponds, boulder fields, and a large persistent snowbank at the upper end. In the small rills feeding the lake, the icy water abounds with *Hydrogrimmia. Andreaea heinemannii* and *A. rupestris* can occasionally be found, along with *Grimmia*

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incurva, on large boulders. Quiet pools between the sedge tussocks are filled with floating mats of *Straminergon stramineum* and *Warnstorfia exannulata.* There is a short trail leading west to the thousand-foot chasm of the Chicago Basin, relatively barren of bryophytes. The lake does not empty into this basin; it flows underneath the road to a gently sloping wetland of sedge hummocks (Carices and three species of *Kobresia*). The side of the lake facing the summit is a steep talus slope with bryophytes characteristic of the tundra. *Oreas martiana* is abundant here and forms tight low golden-green turfs. There are bare, gravelly slopes, dark overhangs at the bases of huge boulders. A lucky observer can find a great variety of species in small quantity, such as *Mnium spinosum*, *Plagiobryum zierii*, and *Racomitrium fasciculare.*

The Mount Epaulet Saddle is a broad, level, rocky, wet tundra area at 13,500 feet, just below the road as it winds toward the summit. We have only recently begun to explore it, but find it has an extraordinary collection of interesting species of mosses (and one of four or five known sites in the Western Hemisphere (all in Colorado) for the Himalayan foliose lichen, *Allocetraria stracheyi*). *Oreas* is abundant here, along with *Aulacomnium "palustre* var. *imbricatum"*, which forms pure stands, green mounds of loosely grouped stems with blunt, cucullate, appressed leaves showing no visible tomentum; it does not produce gemma stalks. This is said to occur rarely in Europe and the Lake Baikal area. Its taxonomic position is controversial, but it is something well worth seeing. Here we have found excellent fruiting material of *Voitia nivalis*, otherwise known from an old collection made by Trelease on nearby McClellan Ridge.

We believe there is much more to be discovered here, and would especially welcome alpine bryologists from Eurasia, for they always bring eyes adapted to recognizing species that we may be unaware of.

Alpine bryophytes of Mount Evans

(Numbers refer to herbarium COLO accessions. Bold-faced taxa are especial rarities) S=Summit Lake only; E= Mount Epaulet saddle

Mosses

Andreaea heinemannii: 4475 (S)
Anomobryum julaceum: 58532 (S)
Atrichum undulatum: 4359 (S)
Aulacomnium palustre
    var. imbricatum: 15844 (E)
Bartramia subulata: 16014
B.collinum var. subjulaceum
B. turgidum: 11003 (S)
Bryoerythrophyllum ferruginascens:
    39080
B. recurvirostre: 39094
Bryum algovicum: 93694
Br. alpinum: 16524
B. pseudotriquetrum: 39096
B. wrightii: 110913
Campylopus schimperi: 21676
Cirriphyllum cirrosum: 1406
Dicranoweisia crispula: 4474
D. elongatum: 4464
D. groenlandicum: 11032 (S)
Didymodon asperifolius: 11039

Distichium capillaceum: 4469
D. inclinatum: 36519
D. flexicaule: 36518
Drepanocladus aduncus: 110498
Encalypta rhaptocarpa: 4463
E. vulgaris: 4471
Entodon concinnus: 4348
Isopterygium pulchellum: 4460
Fissidens osmundoides: 15321
Grimmia donniana: 4343
G. elatior: 4361
G. incurva: (on loan) (S)
Hydrogrimmia mollis: 4352
Hylocomium alaskanum: 4346
Hypnum revolutum: 4351
Meiotrichum lyallii: 4466
Mnium blyttii: 4461
M. spinosum: 22449 (S)
M. thomsonii: 4478
Myurella julacea: 110496 E
Oncophorus virens: 23113
O. wahlenbergii: 219
Oreas martiana: 4341
Paraleucobryum enerve: 23461
Paraleucobryum longifolium: 10883
Plagiobryum demissum: 23651
P. zierii: 40082 (S)
Plagiomnium ellipticum: 11027
Plagiothecium denticulatum: 4470
Pogonatum urnigerum: 4357 (S)
Pohlia cruda: 11252
P. elongata var. minor: 4458
P. longicolla: 4358
P. proligera: 4354
Polytrichastrum alpinum: 3242
P. longisetum: 4359
Racomitrium canescens: 4362
Racomitrium fasciculare: 24886
Sanionia uncinata: 9288
Sarmenthypnum sarmentosum: 17104
Schistidium agassizii: 36117
S. alpicola: 4472
S. flaccidum: E
S. frigidum: E
S. papillosum: 101485
Scorpidium revolvens: 93474
Splachnum sphaericum: (on loan) S
Stegonia latifolia: 44559
Straminergon stramineum: 18112
Tayloria hornschuchii: 4355 E
Timmia austriaca: 4451
Tortella arctica: 11613
Tortula latifolia: 11614
T. systylia: 4459
Trichostomum tenuirostre: 4360
Voitia nivalis: 111028
Warnstorfia exannulata: 60467

Hepatics

Anthelia juratzkana: 91934
Blepharostoma trichophyllum: 11251
Cephaloziella divaricata var. scabra: 4450
Gymnocolea inflata: 10879
Gymnomitrion corallioides: 19885
Jungermannia exsertifolia: 25723
J. sphaerocarpa: 4452
Lophozia attenuata: 21828
L. barbata: 21858
L. hatcheri: 4347
L. incisa: 21844
Plagiochila porelloides: 8910
Scapania hyperborea: 25421
S. mucronata: 36118
Tritomaria exsecta: 10878
Tritomaria polita: 11036

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Bryophyte records for Arkansas III

Piers Majestyk[1]

A total of 89 county records have been identified from 12 Arkansas counties. Five of these, *Bryum subalpiculatum* Hampe, *Bryum violaceum* Crundw. & Nyh., *Ephemerum cohaerens* (Hedw.) Hampe, *Micromitrium megalosporum* Aust., and *Tortula muralis* Hedw., are reported for the first time in the state. *Ditrichum lineare* (Sw.) Lindb., reported for the state by Crum & Anderson (1981) but without a specific locality, is confirmed for the state. Voucher specimens for all species collected are housed in NY with the exception of the two *Bryum* state records and the *Tortula muralis* collection which are in the author's personal herbarium. Collections are listed alphabetically by family. County names are in boldface. Collector and collection number are italicized and follow the county name. New state records are proceeded by an asterisk. Nomenclature for the mosses for the most part follows Anderson (1990) and Anderson et al. (1990). Liverwort nomenclature for the most part follows Stotler & Crandall-Stotler (1977).

Mosses

AMBLYSTEGIACEAE

Amblystegium varium (Hedw.) Lindb. - **St. Francis**: *Majestyk 2398.*

Leptodictyum riparium (Hedw.) Warnst. - **Howard**: *Majestyk 2609.*

ANOMODONTACEAE

Anomodon attenuatus (Hedw.) Hüb. - **Prairie**: *Majestyk 2390*; **Sevier**: *Majestyk 2614*; **St. Francis**: *Majestyk 2402.*

A. minor (Hedw.) Fürnr. - **Prairie**: *Majestyk 2384.*

AULACOMNIACEAE

Aulacomnium heterostichum (Hedw.) Schimp. - **Sharp**: *Buck 40396.*

A. palustre Sw. - **Grant**: *Majestyk 2359.*

BARTRAMIACEAE

Bartramia pomiformis Hedw. - **Sharp**: *Buck 40409.*

BRACHYTHECIACEAE

Brachythecium acuminatum (Hedw.) Aust. - **Howard**: *Majestyk 2590*; **Sharp**: *Buck 40401.*

Eurhynchium pulchellum (Hedw.) Jenn. - **St. Francis**: *Majestyk 2399.*

Steerecleus serrulatus (Hedw.) Robins. - **Howard**: *Majestyk 2592.*

BRYACEAE

Bryum capillare Hedw. - **Sharp**: *Buck 40456.*

B. dichotomum Hedw. - **Grant**: *Majestyk 2367*; **Izard**: *Buck 40333*; **Sevier**: *Majestyk 2628.*

B. pseudotriquetrum (Hedw.) Gaertn. et al. - **Howard**: *Majestyk 2611.*

*B. *subalpiculatum* Hampe - **Howard**: *Majestyk 2606.*

B. violaceum* Crundw. & Nyh. - **St. Francis: *Majestyk 2400.*

---

[1] New York Botanical Garden, Bronx, NY 10458

Rhodobryum ontariense (Kindb.) Par. - **Sharp**: *Buck 40473.*
CAMPYLIACEAE
Campylium hispidulum (Brid.) Mitt. - **Prairie**: *Majestyk 2385.*
CLIMACIACEAE
Climacium americanum Brid. - **St. Francis**: *Majestyk 2397.*
CRYPHAEACEAE
Cryphaea glomerata Bruch & Schimp. *ex* Sull. - **Grant**: *Majestyk 2357.*
DICRANACEAE
Dicranella heteromalla (Hedw.) Schimp. - **Grant**: *Majestyk 2361.*
DITRICHACEAE
Ditrichum lineare (Sw.) Lindb. - **Stone**: *Buck 40384.*
D. pallidum (Hedw.) Hampe - **Prairie**: *Majestyk 2382*; **St. Francis**: *Majestyk 2404.*
ENTODONTACEAE
Entodon seductrix (Hedw.) Müll. Hal. - **Sevier**: *Majestyk 2618.*
EPHEMERACEAE
Ephemerum cohaerens* (Hedw.) Hampe - **Sharp: *Buck 40477.*
Micromitrium megalosporum* Aust. - **Stone: *Buck 40352.*
FABRONIACEAE
Clasmatodon parvulus (Hampe) Hook. & Wils. *ex* Sull. *in* Gray - **Prairie**: *Majestyk 2383*; **Sevier**: *Majestyk 2615*; **Sharp**: *Buck 40398*; **St. Francis**: *Majestyk 2396.*
FISSIDENTACEAE
Fissidens bushii (Card. & Thér.) Card. & Thér. - **Sharp**: *Buck 40436.*
F. dubius P. Beauv. - **Grant**: *Majestyk 2372*; **Izard**: *Buck 40329.*
FONTINALACEAE
Fontinalis welchiana Allen - **Howard**: *Majestyk 2604.*
GRIMMIACEAE
Schistidium rivulare: (Brid.) Podp. - **Howard**: *Majestyk 2600*; **Izard**: *Buck 40237*; **Sharp**: *Buck 40438*; **St. Francis**: *Majestyk 2410.*
HYPNACEAE
Isopterygium tenerum (Sw.) Mitt. - **Prairie**: *Majestyk 2392*; **Sevier**: *Majestyk 2626.*
Platygyrium repens (Brid.) Schimp. *in* B.S.G. - **Howard**: *Majestyk 2593*; **Prairie**: *Majestyk 2391.*
Pylaisiella selwynii (Kindb.) Crum, Steere & Anderson - **Sharp**: *Buck 40517.*
LEPTODONTACEAE
Forsstroemia trichomitria (Hedw.) Lindb. - **Sevier**: *Majestyk 2623.*
LESKEACEAE
Haplocladium microphyllum (Hedw.) Broth. - **Prairie**: *Majestyk 2388.*
LEUCOBRYACEAE
Leucobryum albidum (Brid. *ex* P. Beauv.) Lindb. - **Howard**: *Majestyk 2597.*
LEUCODONTACEAE
Leucodon julaceus (Hedw.) Sull. - **Howard**: *Majestyk 2594*; **Sevier**: *Majestyk 2620*; **St. Francis**: *Majestyk 2401.*
MNIACEAE
Plagiomnium cuspidatum (Hedw.) T. Kop. - **Howard**: *Majestyk 2591.*
ORTHOTRICHACEAE
Orthotrichum strangulatum P. Beauv. - **St. Francis**: *Majestyk 2409.*
POLYTRICHACEAE

Atrichum angustatum (Brid.) Bruch & Schimp. *in* B.S.G. - **Prairie**: *Majestyk 2386*; **St. Francis**: *Majestyk 2413.*
Polytrichum commune Hedw. - **St. Francis**: *Majestyk 2394.*
P. ohioense Ren. & Card. - **Sevier**: *Majestyk 2633*; **Sharp**: *Buck 40430.*
POTTIACEAE
Barbula indica (Hook.) Spreng. *in* Steud. - **Sharp**: *Buck 40479.*
Syntrichia pagorum (Milde) Amann - **Sevier**: *Majestyk 2641*; **St. Francis**: *Majestyk 2407b.*
Tortella humilis (Hedw.) Jenn. - **Prairie**: *Majestyk 2387*; **St. Francis**: *Majestyk 2408.*
Tortula muralis* Hedw. - **Sevier: *Majestyk 2632.*
Weissia controversa Hedw. - **Sevier**: *Majestyk 2617.*
W. jamaicensis (Mitt.) Grout - **Izard**: *Buck 40261.*
SEMATOPHYLLACEAE
Sematophyllum adnatum (Michx.) Britt. - **Izard**: *Buck 40227.*
SPHAGNACEAE
Sphagnum affine Ren. & Card. - **Grant**: *Majestyk 2352.*
S. cyclophyllum Sull. & Lesq. *in* Sull. *in* Gray - **Grant**: *Majestyk 2350a.*
THELIACEAE
Thelia hirtella (Hedw.) Sull. *in* Sull. & Lesq. - **Izard**: *Buck 40260.*
T. lescurii Sull. *in* Sull. & Lesq. - **Izard**: *Buck 40215.*
THUIDIACEAE
Thuidium delicatulum (Hedw.) Schimp. - **Howard**: *Majestyk 2579.*
Liverworts
JUBULACEAE
Frullania brittoniae Evans - **Sharp**: *Buck 40390*; **Yell**: *Hyatt 10677.*
F. riparia Hampe *ex* Lehm. - **Izard**: *Buck 40312.*
LEJEUNEACEAE
Cololejeunea biddlecomiae (Aust.) Evans - **Sharp**: *Buck 40476.*
Leucolejeunea clypeata (Schwein.) Evans - **Sharp**: *Buck 40400*; **Yell**: *Hyatt 10676.*
LOPHOCOLEACEAE
Chiloscyphus profundus (Nees) Engel & Schust. - **Sharp**: *Buck 40481.*
METZGERIACEAE
Metzgeria furcata (L.) Dum. - **Stone**: *Buck 40350.*
PORELLACEAE
Porella pinnata L. - **Marion**: *Hyatt 10631.*
P. platyphylla (L.) Pfeiff. - **Sevier**: *Majestyk 2613.*
RADULACEAE
Radula complanata (L.) Dum. - **Sharp**: *Buck 40427.*
RICCIACEAE
Riccia huebeneriana Lindb. subsp. *sullivantii* (Aust.) Schust. - **Little River**: *Hyatt 10664.*
Ricciocarpos natans (L.) Corda - **Little River**: *Hyatt 10665.*
SCAPANIACEAE
Scapania undulata (L.) Dum. - **Hot Spring**: *Majestyk 2342.*

Acknowledgments. I thank Dr. Bill Buck and Phil Hyatt for allowing me to publish their collection records. I also thank Dr. Paul Redfearn for examining some of my *Bryum* collections.

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Andrews Foray in Southern Maine, September 13-15, 2002

The 27th annual A. Leroy Andrews Foray will be held September 13-15, 2002 in York County, Maine. Lodging will be at Oceanwood in Ocean Park, Maine. Field trips will visit the Massabesic Experimental Forest, a large and varied area in Alfred and Waterboro, Maine with one of the northernmost Atlantic white cedar swamps, as well as both a coastal wetland/barrier beach complex and a raised bog in Saco, Maine.

If you are not on the current Foray mailing list and would like more information, please notify Betsy Newcomer, 1044 Middle Rd, Parsonsfield, ME 04047. E-mail: newcomer@psouth.net.

Fertile Usnea longissima in Washington, U.S.A.

Tor Tønsberg

Abstract. *An abundantly fertile specimen of* Usnea longissima *is reported from Washington, U.S.A.*

According to Keon (2002), *Usnea longissima* is seldom found fertile. In the Pacific northwest of North America, fertile specimens are currently known only from two localities, one in Oregon (treated by Keon) and one in British Columbia (Queen Charlotte Islands, see Keon 2002, Halonen et al. 1998). Prompted by Keons paper, I here report a fertile specimen I collected while studying corticolous crusts in Washington in 2001.

Usnea longissima Ach.
U.S.A. Washington, Snohomish Co., SSE of Darrington, along Rd FR 20, just W of Sauk River, at the bridge at the junction of the rivers White Chuck and Sauk River, 48°10.2'N, 121°28.3'W (WGS84), alt. 290-300 m, corticolous over small deciduous tree (?*Alnus rubra*), 7 May 2001, *Tønsberg 29214* (BG).

Results. The specimen consisted of three main strands that were loosely fastened to a phorophyte twig; the largest strand was about 34 cm long. The central axes were I+ blue. About 100 apothecia were present, each terminal on a side branch. The largest apothecium was 4 mm in diameter. Asci with spores were abundant; spores were 5-10 × 4-7 μm with average spore 8.0 × 5.8 μm (based on 40 spores from 4 apothecia). The thallus contained usnic acid and barbatic acid with 4-O-demethylbarbatic acid (TLC). The supporting tree (?*Alnus rubra*) grew on a river bank in mixed stand with deciduous trees and conifers. Entangled within the fertile material was a sterile specimen of *U. longissima* with large soralia; that specimen contained usnic acid only (TLC).

Discussion. I know nothing about the occurrence of apothecia (and soralia) in the Snohomish Co. population of *Usnea longissima*. However, as indicated by Keon (2002), apothecia are presumably rare. This agrees with Howard (1950) who noted that fertile specimens had not been seen in Washington State. According to McCune & Geiser (1997) and Noble (1982), soredia are also rare in *U. longissima* in the Pacific Northwest. The specimen cited above had apparently become lodged the understory vegetation from a position higher in the canopy. If it is true that apothecia and soredia are rare in Snohomish Co., the production of apothecia and soredia in this material could possibly be explained as a response to environmental stress (see Keon 2002 for a discussion of dispersal strategies for *U. longissima*). It is

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noteworthy that Keon (2002) found few spores in the Oregon specimens, whereas spores were abundant in the Washington material.

Goward (1999) reported 5 chemotypes of *U. longissima* in British Columbia, the most common diagnostic substance being evernic acid followed by barbatic acid (Halonen et al. 1998). Halonen et al. (1998) and Keon (2002) gave no information about the chemical constituents of fertile *U. longissima*. I agree with Keon (2002) in that it would be of interest to assess this species for genetic variability.

Acknowledgements. I thank Trevor Goward, Clearwater, for comments on the manuscript, and Diane and Svein Aronsen, Seattle, for logistic support during field-work in Washington in 2001.

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The Liverwort Flora of Antarctica

H. Bednarek-Ochyra, J. Vana, R. Ochyra & R. I. Lewis Smith (2000): The Liverwort Flora of Antarctica. XVI + 236 + [2] pp., 96 figs. (including 18 colour photographs), 6 tables.

Polish Academy of Sciences, Institute of Botany, Cracow. ISBN 83-85444-74-2. Price: 38,75 US$ (handling and postage).

Foreword by Tamas Pocs
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Introduction
History of the hepaticological investigations
Ecology and conservation
Diversity and phytogeography
Systematic treatment
Glossary
Literature cited
Index to scientific names
About the Authors

The Flora covers the whole of the Antarctic, i.e. all the land south of lat. 60°S including the South Sandwich Islands and the isolated island of Bouvetoya. The introductory chapters presenting topography, geology and climate, history of hepaticological exploration, the Antarctic vegetation and the geographical affinities of the hepatic flora are followed by a systematic treatment including keys to genera and species, illustrated descriptions of each of 27 species, taxonomic notes, local and global distributions maps and extensive citation of specimens and literature records. This is the first treatment of the hepatic flora of the Antarctic.

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The aim of *Evansia* is to provide a vehicle for the presentation and exchange of useful information on North American bryophytes and lichens. Articles are frequently popular in nature rather than technical and are intended to teach and inform both amateurs and professionals. The articles include, but are not restricted to, announcements of and reports on forays and meetings, presentations of techniques and aids for studying and curating lichens and bryophytes, and reports on local floras. Checklists and papers documenting new regional, state, or county records must include voucher specimens (collector and collection number) and an indication of where the specimens are deposited or a literature reference.

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Volume 19 Number 3

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A safe and accurate method to apply spot test chemicals to lichenthalli in the laboratory and the field.

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Pilophorus clavatus and *Pseudocyphellaria crocata* new to the interior of western North America

Toby Spribille

The occurrence of plants with oceanic affinities in inland regions has always fascinated plant geographers in northwestern North America. Already Kirkwood (1927) observed the reappearance of many plant species with coastal affinities in the northern Rocky Mountains. Daubenmire (1969), Johnson & Steele (1978) and especially Lorain (1988) greatly expanded our knowledge of this phenomenon among the vascular plants, while Schroeder & Schroeder (1972), McCune (1984) and Goward (1994) pointed to similar distributions of lichens with oceanic tendencies in the interior.

As part of an ongoing lichenological survey of inland wetbelt forests of northwestern North America, I was referred by Diane Penny of Priest River, Idaho, to a site in southeastern interior British Columbia, near the town of Nakusp. In May 2001, I had the opportunity to visit this site and document its flora. The representation of oceanic species was indeed impressive. Many of the species encountered are rarely found in inland regions, but here they were quite richly represented, particularily around two waterfalls which produced impressive spray zones. Most outstanding though were two species which were previously unknown from interior regions of western North America: the colourfully yellow-sorediate *Pseudocyphellaria crocata* (L.) Vainio and the fruticose saxicolous species *Pilophorus clavatus* Th. Fr..

Pseudocyphellaria crocata was found on branches of trees (mostly *Tsuga heterophylla*) and on vertical rock walls in the spray zone of a waterfall, and it was locally quite abundant. Among the many associated oceanic species were *Pseudocyphellaria anomala*, *Sticta fuliginosa* and *Sticta oroborealis*. Although the species is found around Lake Superior and inland in other portions of eastern North America (Brodo et al. 2001), this is the first definitive inland report of *P. crocata* from western North America.

Pilophorus clavatus appeared to be rare at the Nakusp site. The more common *Pilophorus acicularis* was abundant, occurring on exposed granitic rocks along the trail to Nakusp Hot Springs, but *P. clavatus* was found only in one place. Neither of these species were directly associated with the waterfalls. Subsequently, I found *Pilophorus clavatus* also at one other locality, about 160 km south of Nakusp in the upper Priest River area of extreme northwestern Idaho, only a few kilometres south of the Canadian border. The species was actually abundant here along a hiking trail, colonizing extensive areas of granite which had been exposed during trail construction. Interestingly, there was no sign of *P. acicularis*, which was the only *Pilophorus* species up until now reported from Idaho. The forest vegetation was a combination of *Tsuga heterophylla* and *Thuja plicata* in the overstory and luxuriant undergrowth of the fern *Polystichum munitum*, a forest structure at least physiognomically reminiscent of some coastal rainforests.

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Pilophorus clavatus has been reported to occur rarely on the east slope of the Cascades by McCune & Geiser (1997), but even in British Columbia, where inland oceanic disjuncts are frequent, the species had not been found farther inland than the Kispiox River valley of west-central British Columbia. These collections, more than 400 km from the ocean, represent the first inland reports of the species, which otherwise closely hugs the North American Pacific coastline from Oregon to Alaska and that of eastern Asia from Chukotka to Japan and Taiwan (Jahns 1981).

Specimens:
Pilophorus clavatus. **CANADA. British Columbia.** NE of Nakusp, trail to Nakusp Hot Springs along Kuskanax River, ca. 50°18'N 117°37'W, 11 May 2001, *Spribille 10784* (UBC). **U.S.A. Idaho.** Boundary Co., trail to Upper Priest Falls, ca. 48°59'N 116°55'W, 20 Jul 2001, *Spribille 11175* (CANL, COLO, US).

Pseudocyphellaria crocata. **CANADA. British Columbia.** NE of Nakusp, Gardner Creek on road to Nakusp Hot Springs, ca. 50°18'N 117°42'W, 11 May 2001, *Spribille 10832, 10833* (CANL, UBC).

Acknowledgments. I would like to thank Diane Penny for telling me about the Nakusp site.

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Epigloea (Epigloeaceae) new to North America

William R. Buck and Richard C. Harris

Epigloea Zukal is a genus of algal parasites, usually included in lichen lists. It typically grows on *Coccomyxa*-type algae, infecting them through formation of haustoria. The genus has been monographed (Döbbeler, 1984), with 7 of the 10 recognized species described at that time. The genus is only reported from Europe and subantarctic Marion Island. It is characterized by perithecia embedded in the alga, unitunicate, 8- or polysporous asci, and colorless 2- or 4(–6)-celled ascospores, with or without terminal apiculi. The alga often, but not always, grows over mosses.

To date, two species of *Epigloea* have been collected in the United States. More might be expected once collectors become aware of the genus. In the field, *Epigloea* is difficult to find if the algal substrate is dry. However, if seen while the alga is moist, the perithecia appear as embedded darkish dots. The two species known so far can be separated by the following key:

1. Asci 32-spored; ascospores 6.5–9 × 2–3 µm .... *E. pleiospora*
1. Asci 8-spored; ascospores 9.5–12.5 × 3.5–4.5 µm .... *E. soleiformis*

Epigloea pleiospora Döbbeler, Beih. Nova Hedwigia 79: 225. 1984.

Perithecia 75–150 µm in diameter, the wall dark green around the ostiole and ± hyaline below; ostiole 20–50 µm in diameter. Asci 45–70 × 9–12 µm, 32-spored. Ascospores 6.5–9 × 2–3 µm, 2-celled, colorless, lacking appendages.

Previously known from Europe. Most American collections were collected in relatively dry habitats.

Specimens examined: United States. **Georgia.** COFFEE COUNTY: Broxton Rocks Ecological Preserve, Willow Oak Outcrop, 31°44'22"N, 82°51'51"W, Altamaha Grit outcrop along small stream, growing over *Leucobryum albidum* (Brid.) Lindb., 7 Oct 1999, *W. R. Buck 36589.* **Missouri.** BARRY COUNTY: Roaring River State Park, Roaring River Hills Wild Area along CR F, 36°34'50"N, 93°50'00"W, dolomite glade with *Juniperus*, growing over *Fissidens bushii* (Cardot & Thér.) Cardot & Thér., 3 Nov 2000, *W. R. Buck 38832*; MADISON

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COUNTY: Amidon Memorial Conservation Area, Castor River Shut-Ins Natural Area, off Co. Rd. 235, E of Fredericktown, 37°34'10"N, 90°09'01"W, hardwood-*Juniperus* forest above granitic bedrock along stream, growing over *Dicranum scoparium* Hedw., 21 Oct 2001, *W. R. Buck 40026*, growing over *Aulacomnium androgynum* (Hedw.) Schwägr., *W. R. Buck 40028*. **North Carolina.** BLADEN COUNTY: S of NC 41 along N shore of Bay Tree Lake, 31°41'18"N, 78°24'36"W, mixed hardwoods on coastal plain, growing over *Leucobryum albidum* (Brid.) Lindb., 15 Jun 2002, *W. R. Buck 41894* (all NY).

Interestingly, the bryophyte substrate for one of the collections from Madison County, Missouri, *Aulacomnium androgynum*, is a new record for Missouri and indeed for the entire Interior Highlands. It has been segregated as *W. R. Buck 40028A* and deposited in NY.

Epigloea soleiformis Döbbeler, Beih. Nova Hedwigia 79: 229. 1984.

Perithecia 90–140 µm in diameter, the wall dark green. Asci 40–55 × 8–11 µm, 8-spored. Ascospores 9.5–12.5 × 3.5–4.5 µm, 2-celled, colorless, lacking appendages.

Previously known from Europe and Marion Island. The two American collections were found in a very humid *Thuja* swamp.

Specimens examined: United States. **Wisconsin.** ONEIDA COUNTY: Town of Minocqua, Patterson Hemlocks State Natural Area, 1.2 mi S of St. Hwy 70 on West Clear Lake Road, 45°53'49"N, 89°58'28"W, ca. 450 m, growing on downed *Thuja* trunk, 29 Apr 2002, *W. R. Buck 41784, 41802* (both NY).

Acknowledgments: We thank Ted Ahti for first calling our attention to the genus while on a field trip at Caesar's Head, South Carolina, and although collections from that site proved not be *Epigloea*, subsequent ones did.

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The genus *Sphagnum* (Musci: *Sphagnaceae*) in Maine (Part 2), sections *Cuspidata, Hemitheca, Subsecunda, Polyclada,* and *Acutifolia*

Lewis E. Anderson[1] & Bruce Allen[2]

5. *Sphagnum* Section *Cuspidata* (Lindb.) Schimp., Syn. Musc. Eur. (ed. 2.) 829. 1876.
Sphagnum [unranked] *Cuspidata* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 19: 134. 1862.

Plants loose to rather compact, in hollows, ditches, margins of streams, and ponds, often emergent or submerged. Capitulum usually flat-topped and 5-parted, young pendent branch buds single or paired between branch rays. Stem cortex in 1–4 layers, sometimes poorly differentiated, without pores or fibrils. Stem leaves usually shorter than branch leaves, triangular to triangular-lingulate, acute, broadly rounded to obtuse or sometimes truncate, notched, broadly to narrowly erose, or variously lacerate; hyaline cells extensively resorbed on the inner surface, often in a v-shaped pattern. Branch cortical cells in one layer, efibrillose, usually of different sizes: quadrate to short rectangular ones and enlarged, elongate ones with single, retort-shaped, apical pores. Branch leaves ovate-lanceolate, generally involute-concave, infrequently long-lanceolate; margins entire or occasionally the upper leaves somewhat serrulate near the apex; hyaline cells with few to many pores or pseudopores on the outer surface, on the inner surface aporose or with a few corner or end pores or wall thinnings; green cells in cross section triangular to trapezoidal with greater exposure on the outer surface, at times completely included on the inner surface. Dioicous.

1. Young pendent branch buds paired between the rays in the lower part of the capitulum 2
1. Young pendent branch buds single between the rays in the lower part of the capitulum 5
    2. Stem leaf apices rounded to truncate, moderately to strongly erose, often lacerate 3
    2. Stem leaf apices rounded to apiculate, entire or slightly erose 4
3. Plants moderate-sized to robust; stems somewhat stiff; stem leaves generally lingulate; branch leaves strongly 5-ranked, sharply recurved when dry .... 16. *S. recurvum*
3. Plants small to moderate-sized; stems soft to weak or moderately stiff; stem leaves generally triangular; branch leaves weakly 5-ranked, slightly recurved when dry .... 17. *S. flexuosum*

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4. Plants small, often slender and soft; stems often pinkish; stem leaves obtuse or rounded, at times slightly erose at the tips; stem cortical cells undifferentiated .... 19. *S. angustifolium*
4. Plants moderate-sized, generally stiff; stems not pinkish; stem leaves apiculate to acute (often on the same plant), entire; stem cortical cells somewhat differentiated .... 18. *S. fallax*

5. Stem and branch leaves similar in size, both ovate-lingulate, concave; hyaline cells of the branch leaves short and broad; branch stem retort cells conspicuously long-necked .... 20. *S. tenellum*
5. Stem and branch leaves dimorphic, stem leaves short, more or less triangular, branch leaves ovate- to linear-lanceolate, slightly to moderately concave; hyaline cells of the branch leaves long and narrow; branch stem retort cells not particularly long-necked 6
6. Branch leaf green cells equilaterally triangular in cross section, exposed only on the outer surface; branch leaves strongly 5-ranked (especially when wet) .... 15. *S. pulchrum*
6. Branch leaf green cell isosceles-triangular or trapezoidal; usually exposed on both surfaces; branch leaves not or weakly 5-ranked 7

7. Branch leaf hyaline cells on the outer surface with up to 8 medium to large, central pores, inner surface with none or 1–3 small pores or pseudopores .... 14. *S. majus*
7. Branch leaf hyaline cells on both surfaces with a few, tiny, central pores and a few pores at the ends and corners 8
8. Plants robust, more or less plumose and bristly; capitulum scarcely 5-radiate; stem leaves triangular, apex obtuse to somewhat rounded; branch leaf green cells triangular, scarcely exposed on inner surface; branch leaf margins entire ..... 13. *S. torreyanum*
8. Plants medium-sized to small, scarcely plumose, not bristly (except when immersed); capitulum usually 5-radiate; stem leaves isosceles-triangular, apex acute or apiculate; branch leaf green cells broadly trapezoidal, exposed on both surfaces; branch leaf margins at times serrulate above .... 2. *S. cuspidatum*

12. *Sphagnum cuspidatum* Hoffm., Deutschl. Fl. 2: 22. 1796.

Sphagnum trinitense C. Müll., Syn. Musc. Frond. 1: 102. 1848.

Sphagnum laxifolium var. *serrulatum* Schleiph., Verh. K.K. Zool.-Bot. Ges. Wien 15: 397. 1865.

Sphagnum cuspidatum var. *serrulatum* (Schlieph.) Schlieph., Irmischia 2: 67. 1882.

Sphagnum viridum Flatb., Kongel. Norske Vidensk. Selsk. Skr. [1970 +] 1988(1): 9. 1988.

Plants moderate-sized, slender, weak-stemmed, often elongate, flaccid and somewhat plumose when submerged or emergent, more compact when stranded, uniformly yellow to bright green. Capitulum generally flat, strongly 5-parted, young pendent branch buds between branch rays single. Stem cortical cells in 1 (rarely 2) layer(s) of enlarged thin-walled cells, retort cell necks scarcely raised. Stem leaves isosceles-triangular, acute or minutely apiculate; hyaline cells mostly not divided, outer surface occasionally with small end-pores. Branch cortex retort cells prominent, with inconspicuous necks. Branch leaves mostly unranked, ovate-lanceolate to lanceolate, at the branch tips often greatly elongated; margins at times minutely serrulate to serrate, especially toward apices; hyaline cells on the outer surface with a few small rounded to elliptic, ringed pores at the ends and corners, on the inner surface with a few slightly larger, unringed pores or pseudopores, sometimes with leaf gaps; green cells in cross section isosceles-triangular to trapezoidal, more broadly exposed on the outer surface. Dioicous. Spores more or less 35 μm, papillose.

Illustrations. Crum & Anderson (1981), Fig. 10 H–W; Crum (1984), Figs. 16 & 17 a–b; Daniels & Eddy (1985), Fig. 55.

Aquatic plants completely submerged or emergent with only the capitulum showing, but at times during summer droughts stranded along pool and lake margins or in depressions. Dry plants often becoming white and bleached, but regenerating when conditions improve. In Maine known from Cumberland (*Allen 15899* DUKE, MO), Franklin (*Norton 41* DUKE), Hancock (*Pedano 648* DUKE, MO), Knox (*Merrill 192* MO, NY), Sagadahoc (Allen & Pursell, *Maine Mosses 2* DUKE, MAINE, MO, NY, US), and York (Allen & Pursell, *Maine Mosses 151* DUKE, MAINE, MO, NY, US) Counties.

Sphagnum cuspidatum is a variable species, and this seems to be partly due to the amount of moisture associated with its habitats, *e.g.*, plants that at one time of the year can be completely submerged, and at other times are bone dry. *Sphagnum trinitense* differs from *S. cuspidatum* only in having long-tapered leaves with serrulate margins at the branch tips. These marginal leaf serrulations vary from slight, almost imperceptible bulges at the cell ends to sharply serrate. Populations of *S. trinitense* also vary in the extent of the marginal leaf serrulations. Some populations have serrulate margins only at the leaf tips while others have marginal serrulations on more than half the leaf length. Although plants that are submerged or emergent generally have prominent marginal leaf serrations, serrate leaves also occur on less aquatic plants. *Sphagnum viridum*, a species described from Europe, differs from *S. cuspidatum* in having broader branch leaves, and branch hyaline cells with a broader length to width ratio. It has been reported from Maine, however, we feel the species is unworthy of recognition.

13. *Sphagnum torreyanum* Sull., Mem. Amer. Acad. Arts. 4: 174. 1849.

Sphagnum cuspidatum var. *torreyi* Braithw., Monthly Microscop. J. 13: 64. 1875.

Sphagnum laxifolium var. *miquelonense* Ren. & Card. *ex* Röll, Flora 69: 237. 1886.

Sphagnum cuspidatum var. *miquelonense* (Ren. & Card. *ex* Röll) Ren. & Card. *in* Card., Bull. Soc. Roy. Bot. Belgique 26(1): 56. 1887.

Plants robust, ridgid, stout and elongate, dark-green. Capitulum scarcely 5-radiate, appearing more or less round and bristly, terminal bud scarcely visible, young pendent branch buds between branch rays single. Stem cortical cells in 1–3 layers, but not well-differentiated. Stem leaves triangular, as broad as long, bluntly acute to obtuse or rounded, broadly bordered especially at base; hyaline cells aporose, sometimes fibrillose, divided at base and along sides. Branch cortex enlarged, retort cells conspicuous. Branch leaves unranked, slenderly long ovate-lanceolate, especially elongated at branch tips; margins often undulate when dry and sometimes more or less secund, 3.5–6.0 mm long; hyaline cells on the outer surface with very few small pores, on the inner surface with none or with a few pseudopores; green cells in cross section more broadly exposed on the outer surface, end walls on the concave side varying from ½ the distance to the inner surface to shortly exposed on the inner surface. Dioicous. Spores more or less 28 µm, papillose.

Illustrations. Crum & Anderson (1981), Fig. 11 A–E; Crum (1984), Fig. 17 c–d.

An aquatic species that occupies habitats similar to those of *S. cuspidatum*, and both species are found as far north as Newfoundland. This species, however, is more likely to be found completely submerged or emergent with only the capitulum above water in permanent pools and along the margins of ponds and lakes. It also can be found stranded on wet or moist shores. In Maine known from Cumberland (*Lowe 4* DUKE), Hancock (*Faxon 6/18/1891* NY), Sagahadoc (*Andrus 7177* DUKE, NY), and Washington (*Crum 9/1999* DUKE, NY) Counties.

Sphagnum torreyanum is a handsome, robust species with a dark-green coloration. When growing submerged or emergent *S. cuspidatum* approaches *S. torreyanum* in size and aspect. Plants of *S. torreyanum*, however, are coarser, stiffer, darker, and more plumose than those of *S. cuspidatum*. When dry the branch leaves of *S. torreyanum* are prominently recurved and undulate, while those of *S. cuspidatum* are less recurved and less undulate. The two can be more easily distinguished in the water than when dry in a packet, on the basis of the larger, more bristly, burr-like capitulum of *S. torreyanum* that barely emerges from the water. Microscopically, *S. cuspidatum* differs from *S. torreyanum* in having isosceles-triangular, acute stem leaves, and branch leaf green cells that are consistently exposed on both surfaces. In contrast, *S. torreyanum* has triangular, obtusely rounded stem leaves and branch green cells that are commonly enclosed on the inner surface.

14. *Sphagnum majus* (Russ.) C. Jens., Festskr. Bot. Foren. Kjøbenhavn 106. 1890.

Sphagnum cuspidatum var. *majus* Russ., Arch. Naturk. Liv- Ehst- Kurlands, Ser. 2, Biol. Naturk. 7: 136. 1865.
Sphagnum obtusum var. *dusenii* C. Jens. *in* Warnst., Samml. Eur. Torfm. ser. 1: no. 97. 1888.
Sphagnum dusenii Russ. & Warnst. *in* Warnst., Hedwigia 29: 215. 1890.
Sphagnum dusenii var. *majus* (Russ.) Card., Répert. Sphagnol. 57. 1897.

Plants medium-sized to robust, pale to dark or golden brownish. Capitulum weakly 5-parted, young pendant branch buds between branch rays single. Stem cortical cells poorly differentiated. Stem leaves 1.0–1.8 mm long, more or less triangular-lingulate to somewhat oblong, rounded-obtuse; hyaline cells not divided, somewhat fibrillose on the outer surface near the apex or sometimes efibrillose, largely resorbed on the inner surface. Branch cortex 1-layered, retort cells large, often one above the other, necks inconspicuous. Branch leaves 1.5–2.5 mm long, weakly ranked, ovate-lanceolate, somewhat undulate when dry and usually somewhat subsecund; hyaline cells on the outer surface with many medium to large, unringed central pores, on the inner surface with 0–3 small pores; green cells in cross section trapezoidal, more broadly exposed on the outer surface. Dioicous. Spores more or less 33 μm, coarsely papillose.

Illustration. Crum (1984), Fig. 18.

An aquatic species found submerged or in floating mats, rarely stranded, often in habitats similar to those of *S. torreyanum* and *S. cuspidatum*, sometimes occurring with *S. cuspidatum*. In Maine known from Hancock (*Faxon 7/6/1892* NEBC) and Knox (*Chamberlain & Norton 5330* DUKE) Counties.

This species can be confused with *S. cuspidatum* or *S. torreyanum*, especially when the plants are submerged or emergent. Plants of *S. majus* are usually shorter, and not nearly as long as those of *S. cuspidatum* and *S. torreyanum*. In size and aspect it resembles *S. recurvum*, but in *S. majus* the young pendent branches between the rays of the 5-parted capitulum are single while in *S. recurvum* they are in pairs. Microscopically, *S. majus* is distinguished from all three species by its many (to 8) medium to large, unringed pores on the outer surface of the branch leaf hyaline cells, whereas the other three species have 1-few.

15. *Sphagnum pulchrum* (Lindb. *ex* Braithw.) Warnst., Bot Centralbl. 82: 42. 1900.

Sphagnum intermedium var. γ *pulchrum* Lindb. *ex* Braithw., Sphagnac. Eur. 81. 1878.

Plants medium-sized to somewhat robust, generally yellow-brown, with a sheen when dry, often forming dense or loose mats. Apical buds small; young pendant branch buds between branch rays single. Stem cortex poorly differentiated, in one layer of slightly thickened cells. Stem leaves oblong-triangular to nearly equilateral triangular, obtuse to rounded-obtuse, sometimes slightly apiculate; margins strongly bordered, especially at the base where the lateral borders almost meet; hyaline cells not divided, on the outer surface pores and membrane gaps absent, on the inner surface mostly resorbed or with large membrane gaps. Branch cortical cells 1-layered, retort cells large. Branch leaves strongly 5-ranked, noticeably spiraled, ovate-lanceolate, rather abruptly narrowed to an involute-apiculate apex; hyaline cells with a fairly large membrane gap on the outer surface toward the apex of the leaf, on the inner surface with 3–7 unringed, round pores; green cells in cross section isosceles-triangular, exposed on the outer surface, and reaching only ½ or less toward the inner surface. Dioicous. Spores more or less 27 μm, nearly smooth.

Illustration. Crum (1984), Fig. 22.

Often found in carpets at water level, as floating mats, in poor fens, and raised bogs. In Maine known from Hancock (*Bowers 10059* DUKE, MO), Piscataquis (*Hermann 19663* DUKE), and Washington (*Crum 9/1991* DUKE, MO) Counties.

Sphagnum pulchum is recognized by the combination of its brown stems, ovate-lanceolate branch leaves that are strongly 5-ranked, distinctly spiraled, and have abruptly involute-apiculate apices, and equilaterally triangular branch leaf green cells that are exposed only on the outer surface. It resembles, and can be confused with, *S. recurvum*, *S. angustifolium* and *S. fallax*. *Sphagnum pulchum* differs from those species in having single rather than paired young, pendent branch buds between the rays of the capitulum.

16. *Sphagnum recurvum* P. Beauv., Prodr. Aethéogam 88. 1805.
Sphagnum pulchricoma C. Müll., Syn. Musc. Frond. 1: 102. 1848.

Plants medium-sized to moderately robust, bright green (especially in shade) to yellow-green. Capitulum strikingly 5-ranked; young pendent branch buds between the branch rays paired. Stem cortical cells with 1 layer differentiated. Stem leaves 0.8–1.3 mm long, triangular-lingulate to ligulate, longer than wide, truncate to broadly rounded, erose to somewhat fimbriate; hyaline cells without pores or fibrils, not divided. Branch leaves strongly 5-ranked and spiraled when wet, somewhat undulate and sharply recurved when dry; hyaline cells on the outer surface with a single large pore at the upper end, on the inner surface with several large, unringed, round pores at the corners and along commissures; green cells in cross section isosceles-triangular, base broadly exposed on the outer surface, the apex reaching the inner surface or nearly so. Dioicous. Spores more or less 25 μm, papillose.

Illustrations. Crum & Anderson (1981), Fig. 13 A–H; Crum (1984), Fig. 23 g–i.

Found in loose mats in relatively wet and shaded, or partially shaded habitats, infrequently emergent along lake and pond margins. In Maine known from Cumberland (*Norton 47* DUKE), Franklin (*Norton 42* DUKE), Hancock (*Corrells 11101* DUKE), Kennebec (*Andrus 7205* DUKE, NY), Lincoln (Allen & Pursell, *Maine Mosses 8* DUKE, MAINE, MO, NY, US), Oxford (*Oosting 2133* DUKE), Penobscot (*Merrill 108* NEBC), Piscataquis (*Hermann 19153* DUKE), Sagahadoc (*Andrus 7205* DUKE), Somerset (*Holcombe 409* DUKE), and York (*Norton 17* DUKE) Counties.

Sphagnum recurvum is a moderate to robust species that has large, triangular-lingulate stem leaves. The stem leaves are mostly longer than wide, and they have truncate to broadly rounded apices that are moderately to strongly erose or somewhat lacerate. The branch leaves when wet are in strong spiral rows; when dry they have distinctive wavy-margins and are strongly recurved at the tips.

17. *Sphagnum flexuosum* Dozy & Molk., Prodr. Fl. Bat. 2(1): 76. 1851.

Sphagnum recurvum ssp. *amblyphyllum* Russ., Sitzungsber. Naturf.-Ges. Univ. Dorpat 9: 99. 1890.
Sphagnum recurvum var. *amblyphyllum* (Russ.) Warnst., Bot. Gaz. (Crawfordsville) 15: 219. 1890.
Sphagnum amblyphyllum (Russ.) Zick., Bull. Soc. Imp. Naturalistes Moscou II, 14: 278. 1900.
Sphagnum fallax var. *flexuosum* (Dozy & Molk.) Nyh., Ill. Moss Fl. Fennoscandia. II. Musci 747. 1969.
Sphagnum flexuosum var. *ramosissimum* Andrus, Bryologist 91: 365. 1988.

Plants small to medium-sized. Capitulum with central small branches often curved into a ball-like or hemispheric group when dry, young pendent branch buds between branch rays paired. Stem cortical cells poorly differentiated, in 1 layer. Stem leaves lingulate to somewhat broadly triangular, nearly as broad as long, 0.75–1.3 mm long, truncate to somewhat rounded and more or less erose to weakly lacerate; hyaline cells undivided, usually efibrillose and aporose. Branches weakly 5-ranked, in fascicles of 4–5. Branch leaves ovate-lanceolate, 1.5–2.5 mm long, moderately recurved and wavy when dry; hyaline cells on outer surface with a relatively large pore at the upper end near the apex and a few small, ringed pores at the corners, on the inner surface with several unringed pores and pseudopores along the commissures that are visible with strong staining; green cells in cross section isosceles-triangular, more broadly exposed on the outer surface. Dioicous. Spores more less 25 μm.

Illustrations. Andrus (1980), p. 48; Daniels & Eddy (1985), Fig. 61.

Although *S. flexuosum* is widespread in Eastern North America, it is apparently rare, or else overlooked, in Maine. It has been found on the margin of a heath bog and is said to occur on lake margins and in poor to medium fens (Andrus 1980). In Maine known from Lincoln (*Andrus 7169* DUKE) County.

Sphagnum flexuosum is closely allied to *S. recurvum*, a conspicuous and abundantly collected species. Plants of *S. flexuosum* are generally smaller, lighter in color, and softer than *S. recurvum*, and its branch leaves are less recurved when dry. The capitulum of *S. flexuosum* often has a knot-like cluster in the center that consists of small, curved, young branchlets with markedly recurved juvenile leaves that Andrus (1980) likened to a tiny loose ball of yarn! This character is striking when present, but unfortunately it is not always well-defined, and the same feature sometimes occurs in *S. recurvum*. The principal difference between the two species lies in the shape and size of their stem leaves. In *S. flexuosum* the stem leaves are usually shorter and broader at base than those of *S. recurvum*, they are generally triangular and often as wide as long. The stem leaves of *S. recurvum*, in contrast, are generally lingulate, often longer than wide, and the apex is more broadly rounded, and more erose to lacerate than the stem leaf apices of *S. flexuosum*. The two species are troublesome to separate where their ranges overlap. Crum (1984) treated *S. flexuosum* as a synonym of *S. recurvum* without comment; Nyholm (1969) reduced the species to a variety of *S. fallax*, but Daniels and Eddy (1985) and Isoviita (1966) recognized it at the specific level.

18. *Sphagnum fallax* (Klinggr.) Klinggr., Vers. Topogr. Fl. Westpreuss. 128. 1880.

Sphagnum cuspidatum δ *fallax* Klinggr., Schriften Königl. Phys.-Ökon. Ges. Königsberg 13: 7. 1872.
Sphagnum cuspidatum var. δ *brevifolium* Lindb. *ex* Braithw.,. Sphagnac. Eur. 84. 1878.
Sphagnum recurvum var. *brevifolium* (Lindb. *ex* Braithw.) Warnst., Flora 67: 608. 1884.
Sphagnum recurvum spp. *mucronatum* Russ., Sitzungsber. Naturf.-Ges. Univ. Dorpat 9: 109. 1890.
Sphagnum recurvum var. *mucronatum* (Russ.) Warnst., Bot. Gaz. (Crawfordsville) 15: 218. 1890.
Sphagnum brevifolium (Lindb. *ex* Braithw.) Röll., Bot. Centralbl. 39: 340. 1910.
Sphagnum isoviitae Flatb., J. Bryol.17: 1. 1992.

Plants moderate-sized to somewhat robust, mostly brownish or golden-yellow, often red-flushed. Capitulum usually 5-rayed; young pendent branch buds between branch rays paired. Stem cortical cells with 1 layer differentiated. Stem leaves generally less than 1 mm long, equilateral-triangular or slightly longer than wide, apiculate, rarely obtuse, at times with apiculate and obtuse leaves on the same stem; hyaline cells not divided, usually efibrillose and aporose. Branch leaves spirally ranked when wet, strongly recurved (especially those in the capitulum) when dry, ovate-lanceolate with involute-concave apices, sometimes rather abruptly narrowed to short apices; hyaline cells on the outer surface with a large pore at the upper end and a few small pores or pseudopores at the corners and commissures, on the inner surface with a few corner and commissure pseudopores; green cells in cross section isosceles-triangular, more broadly exposed on the outer surface, somewhat enclosed or reaching the inner surface. Dioicous. Spores more or less 35 μm, finely papillose or smooth.

Illustrations. Crum (1984), Fig. 24 (as *S. recurvum* var. *brevifolium*); Daniels & Eddy (1985), Fig. 63 (as *S. recurvum* var. *mucronatum*).

In loose mats or carpets in hollows or depressions, poor fens, and rarely mires at the bottom of hummocks. In Maine known from Cumberland (*Allen 20282* DUKE, MO), Franklin (*Norton 42* DUKE), Hancock (*Pedano 402* DUKE, MO), Lincoln (*Allen 5033* DUKE, MO), Oxford (*Lowe 11/7/1956* DUKE), Piscataquis (*Hermann 19153* DUKE), Sagadahoc (*Allen 15755* DUKE, MO), Somerset (Allen & Pursell *Maine Mosses 104* DUKE, MAINE, MO, NY, US), Washington (*Pedano 564* DUKE, MO), and York (*Norton 17* DUKE) Counties.

Sphagnum fallax is a moderate to somewhat robust species with stiff stems, and branch leaves that are sharply recurved when dry. In these features as well as overall aspect it resembles *S. recurvum*, and the two are difficult to distinguish in the field. The two species are best distinguished on stem leaf features. The stem leaves of *S. fallax* are broadly triangular, often as broad as long, and some stem leaves are nearly always apiculate. Although the stem leaves can sometimes be shortly or rarely acute, often both apiculate and acute leaves can be found on the same stem. The stem leaf apices of *S. fallax* are never truncate or erose. In contrast, the stem leaves of *S. recurvum* are mostly longer than wide, and they have truncate to broadly rounded apices that are moderately to strongly erose or somewhat lacerate.

19. *Sphagnum angustifolium* (C. Jens. *ex* Russ.) C. Jens. *in* Tolf, Bih. Kongl. Svenska Vetensk.-Akad. Handl. Bd. 16 Afd. 3(9): 46. 1891.

Sphagnum recurvum ssp. *angustifolium* C. Jens. *ex* Russ., Sitzungsber. Naturf.-Ges. Univ. Dorpat 9: 112. 1890.

Sphagnum recurvum var. *tenue* Klinggr., Schriften Königl. Phys.-Ökon. Ges. Königsberg 13: 5. 1872.

Sphagnum brevifolium var. *angustifolium* (C. Jens. *ex* Russ.) Röll., Hedwigia 51: 103. 1911.

Plants small to moderate sized, slender and soft, green to yellowish or golden brown. Capitulum weakly to strongly 5-ranked; young pendant branch buds between branch rays paired. Stems pale green to brown, often pinkish or tinged with red; cortical cells not or poorly differentiated. Stem leaves less than 0.8 mm long, isosceles- to equilateral-triangular, frequently as broad as long, generally rounded to broadly obtuse, apices entire or at times narrowly erose or notched, usually with a few resorbed cells at the very leaf tip; hyaline cells not divided, efibrillose and aporose. Branch cortex retort cells conspicuous, with short necks. Branch leaves moderately 5-ranked when wet, only slightly recurved at the tips when dry, rarely more than 1.2 mm long, ovate-lanceolate; hyaline cells on the outer surface with small pores or pseudopores in the ends and corners, on the inner surface with pseudopores at the ends and angles; green cells in cross section isosceles-triangular, broadly exposed on the outer surface, barely enclosed on the inner surface. Dioicous. Spores more or less 23 µm, finely papillose.

Illustrations. Andrus (1980), pp. 49 & 50; Crum (1984), Fig. 23 d–f.

In open peatlands, fens and mires, in mats and the sides of hummocks, occasionally in floating mats. In Maine known from Androscoggin (*Allen 22467* DUKE, MO), Cumberland (*Norton 53* NY), Franklin (Allen & Pursell *Maine Mosses 101* DUKE, MAINE, MO, NY, US), Hancock (*Rand 8/29/1890* DUKE), Kennebec (*Andrus 7194* NY), Knox (*Crockett 10/3/1905* NEBC), Somerset (*Allen 21421A* DUKE, MO), Waldo (*Johnson 8/1960* DUKE), Washington (*Worthley 237* DUKE, MO), and York (*Norton 9/24/1933* DUKE) Counties.

Sphagnum angustifolium is easily confused with *S. flexuosum*. The two species are best separated on stem leaf characters. In *S. angustifolium* the stem leaves are apt to be more nearly equilateral-triangular, often as wide as long, while the stem leaves of *S. flexuosum* are more lingulate and not as consistently broad at the base. Also, the stem leaves of *S. angustifolium* are rounded to broadly pointed and slightly erose or notched while those of *S. flexuosum* are often truncate and more broadly, deeply erose.

20. *Sphagnum tenellum* (Brid.) Bory, Voy. Îles Afrique 3: 107. 1804.
Sphagnum cymbifolium β *tenellum* Brid., Muscol. Recent. 2(1): 24. 1798.
Sphagnum molluscum Bruch, Flora 8: 635. 1825.

Plants small, soft, slender and weak-stemmed, yellow to pale or golden-brown, rarely with tinges of red. Stem cortical cells moderately enlarged in 2–3 layers. Stem leaves relatively large, slightly wider than the branch leaves, otherwise similar in shape and size, 1.0–1.5 mm long, ovate-oblong, strongly concave, upper margins incurved toward the relatively blunt apex; hyaline cells narrow at base, considerably broader above, sometimes fibrillose, on the outer surface with a few tiny, ringed pores, on the inner surface with 1–2 large, non-ringed pores, occasionally with a few septations, in cross section the hyaline cells greatly convex on the inner surface, not or slightly convex on the outer surface. Branch cortex retort cells large, with long, very conspicuous necks. Branch leaves not in rows, ovate-oblong, concave, appearing broadly acute due to the recurved leaf margins; margins narrow and indistinctly bordered; hyaline cells in cross section large, to 25 µm in diameter, greatly convex on the inner surface, not or slightly convex on the outer surface; green cells in cross section equilateral-triangular or nearly so, broadly exposed on the outer surface. Monoicous. Spores more or less 30 µm, finely papillose.

Illustrations. Crum (1984), Fig. 20; Daniels & Eddy (1985), Fig. 81.

Found in loose carpets in wet hollows and pools, raised or blanket bogs, and ombrotrophic to weakly minerotrophic habitats. This species grows in a variety of wet oligotrophic habitats, often on rocks in seepage areas. In Maine known from Hancock (*Pedano 646* DUKE, MO) and Washington (*Crum 9/91* MO, NY) Counties.

Sphagnum tenellum has traditionally been placed in section *Cuspidata*, but it is certainly the most divergent species in the section. Isoviita (1966) considered its differences from other members of the section so great that it deserved at least the rank of subsection. Although he did not formalize this notion, Daniels and Eddy (1985) resurrected section *Mollusca* to accommodate *S. tenellum*. *Sphagnum tenellum* is not likely to be confused with other members of section *Cuspidata* for several reasons. Its branch and stem leaves are more or less monomorphic in size (both relatively large), shape (oblong-elliptic and very concave with broadly acute apices), and structure. The branch cortical retort cells in *S. tenellum* are very long, and they have remarkably tall necks. The branch leaf marginal borders in this species are very narrow; they consist of only 2–3 rows of very narrow cells. Lastly, the branch and stem hyaline cells on the inner surface are notably short and broad in surface view, and in cross section greatly convex.

6. *Sphagnum* section *Hemitheca* Lindb. *ex* Braithw. Sphagnac. Eur. 30. 1878.
Sphagnum subg. *Hemitheca* (Lindb. *ex* Braithw.) C. Jens., Festskr. Bot. Foren. Kjøbenhavn 63. 1890.

Plants slender, often much elongated, unbranched and elongate, or short branched and compact, yellow-orange, or greenish, purplish brown to pinkish to red or black. Capitulum not noticeable, terminal bud prominent. Stem cortical cells small, in 1–2 layers, aporose. Stem leaves broadly ovate, concave, rounded-obtuse; hyaline cells fibrillose, aporose, in cross section slightly convex on the outer surface, not or slightly convex on the inner surface. Branches none, single or rarely in fascicles of 2–3. Branch leaves similar to stem leaves, but much smaller, at times as wide as long; hyaline cells with thick annular fibrils that appear to divide the cells into square segments, on the outer surface toward the apex with several large irregular membrane gaps, on the inner surface with occasional small pores at the ends, in cross section very slightly convex on the outer surface, not or slightly convex on the inner surface; green cells in cross section broadly rectangular to somewhat trapezoidal, nearly equally exposed on both surfaces or slightly more exposed on the inner surface. Dioicous. Capsules without pseudostomata, spores coarsely roughened.

Section *Hemitheca* is monotypic, and contains only *S. pylaesii*.

21. *Sphagnum pylaesii* Brid., Bryol. Univ. 1: 749. 1827.
Sphagnum sedoides Brid., Bryol. Univ. 1: 750. 1827.

Sphagnum pylaesii var. *ramosum* Warnst., Bot. Gaz. (Crawfordsville) 15: 243. 1890.

Plants slender, often much elongated, unbranched and elongate, or short branched and compact, yellow-orange, or greenish, purplish brown to pinkish to red or black. Capitulum not noticeable, terminal bud prominent. Stem cortical cells small, in 1–2 layers, aporose. Stem leaves 1.5–2.5 mm long, 1.0–1.3 mm wide, broadly ovate, concave, rounded-obtuse; hyaline cells fibrillose, aporose, in cross section slightly convex on the outer surface, not or slightly convex on the inner surface. Branches none, single or rarely in fascicles of 2–3. Branch leaves similar to stem leaves, but much smaller, more or less 1 mm long, at times as wide as long; hyaline cells with thick annular fibrils that appear to divide the cells into square segments, on the outer surface toward the apex with several large irregular membrane gaps, on the inner surface with occasional small pores at the ends, in cross section very slightly convex on the outer surface, not or slightly convex on the inner surface; green cells in cross section broadly rectangular to somewhat trapezoidal, nearly equally exposed on both surfaces or slightly more exposed on the inner surface. Dioicous. Capsules without pseudostomata, spores more or less 35 µm, coarsely roughened.

Illustrations. Crum (1984), Fig. 31; Daniels & Eddy (1985), Fig. 43.

On wet, acid rocks in mountainous terrain, in seepage on rock ledges, shallow pools and depressions in minerotrophic bogs, sometimes submerged, common near the ocean. In Maine known from Hancock (*Allen 3705* DUKE, MO) and Washington (*Pedano 384* DUKE, MO) Counties.

Sphagnum pylaesii occurs in two rather distinct forms which seem to be habitat related. Both forms occur in Maine. One form is reddish to orange-yellow in color, and occurs on seepage rocks and other less wet substrates. It has generally elongate and prostrate stems with few or no branches, and has formally been recognized as *S. sedoides*. The other form is found in wetter situations such as shallow pools and depressions in bogs. Plants of this form are dark-brown to blackish in color and are freely branched. Usually the branches are single, but occasionally they occur in fascicles of 2–3. The two forms intergrade and are not worthy of formal taxonomic recognition.

In some ways *S. pylaesii* resembles species of section *Subsecunda, e.g.*, in cross section the green cells of both are equally exposed on each surface or trapezoidal with slightly more exposure on the inner surface. Nevertheless, *S. pylaesii* possesses a number of distinct features that seem to separate it from section *Subsecunda*. The stem cortex of *S. pylaesii* is well-developed with 1–2 layers of small, thin-walled cells that lack pores and fibrils. In contrast many of the species of section *Subsecunda* have thin-walled, enlarged, porose or fibrillose cortical cells. Furthermore, in *S. pylaesii* the stem and branch leaves are scarcely different, the hyaline cells have thickened annular fibrils that seem to divide the cell into square or rectangular segments (a unique freature), and the marginal leaf borders are narrow or almost non-existent (usually consisting of a single cell). In section *Subsecunda* the leaves of have 3 or more rows of elongated marginal cells.

7. *Sphagnum* section *Subsecunda* (Lindb.) Schimp., Syn. Musc. Eur. (ed. 2). 843. 1876.

Sphagnum [unranked] *Subsecunda* Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 19: 135. 1862.

Plants variable, stems erect, sometimes creeping or ascending. Capitulum well-developed, 5-ranked, with or without terminal buds, or poorly organized; fascicles with few branches or stems unbranched. Stem cortical cells 1–3-layered, aporose or porose, efibrillose. Stem leaves varing from smaller to larger than the branch leaves, at times stem and branch leaves similar in size and shape; triangular with round or pointed apices, oblong, oblong-ovate, or elliptic; hyaline cells divided or undivided, often fibrillose and porose, especially toward the leaf tip, sometimes nearly throughout, with numerous pores along the commissures on 1 or both surfaces. Branches often curved, and sometimes secund, especially in the capitulum; branch cortex efibrillose, retort cells enlarged, short- or infrequently long-necked. Branch leaves ovate-lanceolate, broadly elliptic, or broadly rounded-ovate, narrowly bordered by linear cells; hyaline cells more or less convex on each surface, on the outer surface nearly always with many elliptic, ringed, relatively small pores arranged along the commissures like a string of beads, usually aporose on the inner surface; green cells in cross section truncately elliptic, rectangular or trapezoidal, more or less equally exposed on both surfaces. Dioicous.

The plants that comprise this section are difficult to divide into discrete species. Andrews (1913) in his classical but ultraconservative treatment solved the problem by recognizing only a single species, *S. subsecundum*, with 36 synonyms. The result of following this treatment is nothing short of chaos, but how broad or narrow the species concepts should be are still much disputed by sphagnologists. A thorough and informative discussion of variability in section *Subsecunda* can be found in Krzakowa & Melosik (2000).

1. Stem cortical cells mostly in 2–3-layers, but often 1-layered in parts 2
1. Stem cortical cells mostly in 1-layer, but sometimes 2- layered in parts 3
    2. Terminal bud large and round; pendent and spreading branches not clearly differentiated; stem leaves 1.5–2.0 mm long, broadly ovate-elliptic, fibrillose throughout .... 26. *S. platyphyllum*
    2. Terminal bud small and inconspicuous; pendent and spreading branches well differentiated; stem leaves 0.7–1.4 mm long, oblong-lingulate to lingulate, fibrillose in upper ¼ –½ .... 25. *S. contortum*

3. Stem leaves 0.5–0.8 mm long, fibrillose and porose only near the apex, or rarely more than ¼ the length of the leaf .... 22. *S. subsecundum*
3. Stem leaves 0.7– 2.5 mm long, fibrillose and porose in the upper ¼–½ or at times ¾ the length of the stem leaves 4
   4. Stem leaves with pores more abundant on the outer surface of the hyaline cells or about equal on each surface .... 23. *S. denticulatum*
   4. Stem leaves with pores mostly confined to the inner surface of the hyaline cells, few or none on the outer surface .... 24. *S. inundatum*

22. *Sphagnum subsecundum* Nees *in* Sturm, Deutschl. Fl. Abt. II, Cryptog. 17: [species 3]. 1819.

Plants small to medium-sized, light green, often yellowish to bluish green. Capitulum well-developed, terminal bud small, not obvious. Stem cortex 1-layered (sometimes in part 2-layered), cells enlarged, thin-walled. Stem leaves small, 0.5–0.8 mm long, shorter than the branch leaves, broadly oblong-triangular, concave, apices rounded or sometimes rounded-obtuse; hyaline cells sometimes divided, fibrillose and porose only near leaf apex to less than ¼ the leaf length. Branches in fascicles of 4–6. Branch leaves broadly ovate to ovate-lanceolate, 1–2 mm long, usually curved and somewhat secund; hyaline cells on the outer surface with numerous small, elliptic pores along the commissures, like a string of beads, on the inner surface with a few small, ringed pores at the ends and corners; green cells in cross section exposed equally on both surfaces or slightly more on the outer surface. Dioicous. Spores more or less 24 µm, nearly smooth.

Illustrations. Andrus (1980), p. 34; Crum (1984), Fig. 33.

In soft cushions, or thin mats in minerotrophic, wet habitats, often on wet, drippy rock shelves, edges of ponds, and sedge marshes. In Maine known from Androscoggin (*Allen 21783* DUKE, MO), Cumberland (*Allen 15910* DUKE, MO), Hancock (*Faxon 6/20/1890*, NEBC) Kennebec (*Allen 14766* DUKE, MO), Knox (*Andrus 7168* DUKE), Lincoln (*Solomon 20148* DUKE, MO), Penobscot (*Merrill 107* NEBC), Piscataquis (*Lowe 8/22/1949* DUKE, MO), and York (*Lombard 1* DUKE) Counties.

Sphagnum subsecundum is a small to medium-sized species with stem leaves shorter than the branch leaves that usually is not difficult to recognize. Plants from aquatic or very wet habitats have a distinctive dirty-green or slightly bluish color, while plants from drier habitats vary from brown to yellow-green, or orange-green. The stem cortical cells in *S. subsecundum* are mostly 1-layered, but here and there the cortical cells are doubled. This can cause confusion since in some cases it is difficult to determine if the specimen is 1- or 2-layered. In Maine *S. contortum* is a multi-layered species that is similar to *S. subsecundum* in having stem leaves shorter than the branch leaves and a small terminal bud. *Sphagnum contortum* differs from *S. subsecundum* in having the stem cortex at least 3-layered in some areas of the stem, and larger stem leaves (0.7–1.4 mm long) that are fibrillose in the upper ¼ to ½ . In *S. subsecundum* the stem cortex is never 3-layered, the stem leaves are normally less than 1 mm long (often they are nearly as wide as long), and they have pores and fibrils on the hyaline cells in the upper ¼ or less of the leaf.

23. *Sphagnum denticulatum* Brid., Bryol. Univ. 1: 10. 1826.
Sphagnum contortum var. *rufescens* Nees & Hornsch., Bryol. Germ. 1: 15. 1823.
Sphagnum subsecundum var. *rufescens* (Nees & Hornsch.) Hüb., Muscol. Germ. 26. 1833.
Sphagnum contortum var. *obesum* Wils., Bryol. Brit. 22. 1855.
Sphagnum lescurii Sull. *in* Gray, Manual (ed. 2) 611. 1856.
Sphagnum auriculatum Schimp., Mém. Hist. Nat. Sphaignes 79. 1857.
Sphagnum obesum (Wils.) Warnst., Samml. Eur. Torfm. ser. 2: no. 120. 1890.

Plants moderate-sized to robust especially when submerged or emergent, upright or rarely prostrate, green, yellowish, yellow-brown with an orange cast, or often with a light bluish tinge. Capitulum strongly to weakly 5-parted or rarely indistinct. Stem cortex of enlarged thin-walled cells in 1-layer, but sometimes 2-layered in parts, sometimes with large pores or wall-thinnings at the cell ends. Stem leaves 0.7– 2.5 mm long, lingulate-triangular to triangular with rounded apices or (when hemi-isophyllous) pointed, apiculate or narrowly truncate; hyaline cells usually with as many divided as undivided cells, 1- to 2-septate, porose and fibrillose ¼–¾ toward the base, on the outer surface pores often in commissural rows, on the inner surface fewer or none. Branch leaves 1.5–2.5 mm long, loosely to tightly imbricate, spreading or rarely somewhat secund, generally larger than the stem leaves; spreading branches sometimes tumid with closely imbricate leaves; hyaline cells on the outer surface with numerous small, elliptic, ringed pores, crowded and like a string of beads along the commissures, on the inner surface pores fewer or none; green cells in cross section rectangular, end walls thickened, equally exposed or slightly more exposed on the outer surface, lumina more or less elliptic. Dioicous. Spores more or less 30 µm, finely papillose.

Illustrations. Crum (1984), Fig. 34 d–e (as *S. subsecundum* var. *rufescens*); Daniels & Eddy (1985) Fig. 49 (as *S. auriculatum*).

Found in a wide variety of habitats, from substrates intermittently wet and dry, in open or deeply shaded places, and weakly minerotrophic, permanent wetlands. It occurs on seepage rocks, ledges and open flat rock exposures, both acidic and basic. In Maine known from Androscoggin (*Allen 21764* DUKE, MO), Cumberland (*Allen 20268* DUKE, MO), Franklin (*Dunham 9/1906* NEBC), Hancock (*Rand 8/28/1891* NY), Lincoln (*Allen 13074* DUKE, MO), Oxford (*Allen 10106* DUKE, MO), and York (*Fernald 220* NEBC) Counties.

In North America this species has generally been called *S. subsecundum* var. *rufescens* or *S. lescurii*. In the British Isles and much of Europe and Asia it goes under the name *S. auriculatum*. Dirkse and Isoviita (1986) studied the type of *S. denticulatum,* and concluded it is a form of *S. auriculatum*. *Sphagnum denticulatum* is an earlier name and so replaces *S. auriculatum* in Europe. We also have no hesitation in replacing *S. lescurii* with the older name, *S. denticulatum*, in North America.

In size and structure *S. denticulatum* seems to be very much influenced by changes in its habitat. There is a size gradient and aspect associated with plants depending upon whether they are immersed, emergent, or occupy various degrees of wetness in bogs and swamps. Emergent or submerged plants can be robust, have long stems, tumid spreading branches, and (especially when dry) closely overlapping leaves. In this form the species macroscopically resembles species of section *Sphagnum*. In less aquatic situations the plants are medium-sized, soft, loose, and have erect or spreading branch leaves. The stem leaves of *S. denticulatum* range from 1.3 to 2.5 mm in length, vary from lingulate to ovate, and are very concave with rounded, obtuse or truncate apices. The stem leaf hyaline cell pores are usually present on the upper ½ or more of the leaf, and although they are generally more numerous on the outer surface than on the inner surface, at times both surfaces have about equal numbers of pores.

24. *Sphagnum inundatum* Russ., Arch. Naturk. Liv- Ehst- Kurlands, Ser. 2, Biol. Naturk. 10: 390. 1894.

Sphagnum subsecundum var. *inundatum* (Russ.) C. Jens., Bot Faeröes 1: 139. 1901.

Sphagnum auriculatum var. *inundatum* (Russ.) Hill, J. Bryol. 8: 439. 1975.

Sphagnum subsecundum ssp. *inundatum* (Russ.) A. Eddy, J. Bryol. 9: 313. 1977.

Plants generally medium-sized, yellow-green to brownish or orange, often with a bluish tinge. Capitulum with small, inconspicuous terminal bud. Stem cortical cells 1-layered, but sometimes 2-layered in parts. Stem leaves 0.7–1.5 mm, lingulate to lingulate-triangular with rounded to obtuse apices, fibrillose and porose about ¼ to ½ or more from the tip; hyaline cells on the inner surface with numerous pores in commissural rows, on the outer surface few or none. Branch cortext differentiated, retort cells with inconspicuous necks. Branch leaves ovate to ovate-lanceolate, somewhat curved, margins involute; hyaline cells on the outer surface with numerous small elliptical, ringed pores in commissural rows, on the inner surface with a few corner or end pores; green cells in cross section about equally exposed on both surfaces or slightly more exposed on the outer surface, end-walls thickened, lumina oval to elliptical. Dioicous. Spores more or less 25 µm, papillose.

Illustrations. Crum (1984), Fig. 34 f–g (as *S. subsecundum* var. *inundatum*); Daniels & Eddy (1985), Fig. 47 (as *S. subsecundum* subsp. *inundatum*).

Found on wet substrates in somewhat minerotrophic habitats such as margins of lakes, ponds, and marshes, occasionally partially submerged, and on wet, rocky ledges in seeps and on dripping rocks. In Maine known from Androscoggin (*Allen 21783* DUKE, MO), Franklin (Allen & Pursell, *Maine Mosses 105* DUKE, MAINE, MO, NY, US), Hancock (*Rand 7/24/1890* NEBC), Knox (*Allen 14626* DUKE, MO), Oxford (*Parlin 8/3/1928* NEBC), and York (*Garritson 7/1901* NEBC) Counties.

Sphagnum denticulatum and *S. inundatum* are not easy to separate. The two species are generally distinguished on stem leaf features. Typically, the stem leaves of *S. inundatum* are smaller (1.0–1.5 vs. 1.0– 2.5 mm long) than those of *S. denticulatum*, weakly concave, and have numerous commissural pores and fibrils on the inner surface of the hyaline cells but few, if any, on the outer surface. The larger stem leaves of *S. denticulatum* on the other hand are more concave than those of *S. inundatum*, and have numerous commissural pores and fibrils on the outer surface but few, if any, on the inner surface. These characters are somewhat arbitrary, overlapping, and unfortunately require making judgmental decisions.

25. *Sphagnum contortum* Schultz., Prodr. Fl. Starg. Suppl. 64. 1819.

Sphagnum subsecundum var. *contortum* (Schultz) Hüb., Muscol. Germ. 27. 1833.

Plants small to medium-sized, yellow-green to brownish. Capitulum branches mostly curved, terminal bud small. Stem cortex with 2–3 layers of thin-walled cells having large pores or thinnings at the ends. Stem leaves 0.7–1.4 mm long, about the same length as the branch leaves, oblong-lingulate to lingulate, rounded-obtuse, concave at the apices; hyaline cells not divided, fibrillose in the upper ¼ to ½ or more. Branches usually curved. Branch leaves 1–2 mm long, more or less secund and somewhat spreading, broadly ovate to ovate-lanceolate; hyaline cells on the outer surface with numerous tiny pores along commissures, or sometimes few and scattered, on the inner surface pores scattered or absent; green cells in cross section somewhat trapezoidal, equally exposed or slightly more exposed on the outer surface, end-walls thickened, lumina elliptic. Spores more or less 25 µm, papillose.

Illustrations. Crum (1984), Figs. 37 & 38c–e; Daniels & Eddy (1985), Fig. 53.

A minerotrophic or eutrophic species found in sedgy habitats, rich fens, and slightly basic mires, normally in open places. In Maine known from Kennebec (*Andrus 7200* DUKE) and Sagahadoc (*Andrus 7164* DUKE) Counties.

Sphagnum contortum and *S. platyphyllum* are distinguished from the other members of section *Subsecunda* by their 2–3-layered stem cortex. *Sphagnum platyphyllum* differs from *S. contortum* in having a large and very prominent terminal bud, and tumid branches that are not clearly differentiated into pendent and spreading branches. In contrast *S. contortum* has small, inconspicuous terminal buds, and clearly differentiated pendent and spreading branches. Also, the stem leaves of *S. contortum* are oblong-lingulate to lingulate, normally less than 1.3 mm long (0.7–1.4 mm), and fibrillose only in the upper ¼ –½. The stem leaves of *S. platyphyllum* are broadly ovate-elliptic, generally more than 1.5 mm (1.5–2.0 mm) in length, and fibrillose throughout. The tiny pores on the branch leaf hyaline cells of *S. contortum* are a distinctive feature of that species.

26. *Sphagnum platyphyllum* (Lindb. *ex* Braithw.) Sull. *ex* Warnst., Flora 67: 481. 1884.

Sphagnum laricinum γ platyphyllum Lindb. *ex* Braithw., Monthly Microscop. J. 13: 230. 1875.
Sphagnum subsecundum var. *platyphyllum* (Lindb. *ex* Braithw.) Cardot, Bull. Soc. Roy. Bot. Belgique 25(1): 73. 1886.
Sphagnum missouricum Warnst. & Card. *in* Warnst, Hedwigia 47: 93. 1907.
Sphagnum contortum var. *platyphyllum* (Lindb. *ex* Braithw.) Åberg, Ark. Bot. 29A(1): 34. 1937.

Plants medium-sized, branches sparse, in fascicles of 2–3, rarely unbranched. Capitulum with large and conspicuous terminal bud, especially when wet. Stem cortex with 2–3 layers of thin-walled cells usually having a large pore or wall thinning at the upper cell end. Stem leaves 1.5–2.0 (–3) mm long, broadly ovate-elliptic, strongly concave, apices rounded; hyaline cells fibrillose throughout, on the outer surface with rows of tiny pores along the commissures, sometimes interrupted, on the inner surface with none or a few scattered pores, especially at cell ends and corners. Branches straight, short, tumid, rarely exceeding 10 mm in length, not clearly differentiated into pendent and spreading branches; branch cortical cells moderately distinct, retort cells short necked, in linear rows of 3–4 cells. Branch leaves similar to stem leaves, straight, imbricate, concave, 1.5–2.5 mm long; green cells in cross section somewhat trapezoidal, about equally exposed, end-walls thickened, lumina oval to slightly elliptic. Dioicous. Spores more or less 30 μm, papillose.

Illustrations. Crum (1984), Figs. 38a–b; Daniels & Eddy (1985), Fig. 51.

Found in minerotrophic habitats, especially in submerged to emergent shallow water at the margins of lakes, pools, ponds or sedge meadows, fens, and mires. Not yet known from Maine, but present in Massachusetts, New Hampshire, and Quebec (Andrus *pers. comm.*).

Sphagnum platyphyllum, like *S. contortum*, has a stem cortex that consists of 2–3 layers of enlarged, thin-walled, hyaline cells. Distinctive characters of *S.*

platyphyllum include its large, prominent terminal bud, short, straight, tumid branches that are scarcely differentiated into pendent and spreading, branch cortical retort cells that occur in linear rows of 3–4 cells, and large stem and branch leaves that are similar in structure. In contrast *S. contortum* has small, inconspicuous terminal buds, clear pendent/spreading branch differentiation, and smaller (0.7–1.4 vs 1.5–2.0 mm long) stem leaves that are fibrillose only in the upper ¼ –½. The stem leaves of *S. platyphyllum* are fibrillose throughout

8. *Sphagnum* section *Polyclada* (Warnst.) Russ. *ex* Horrell, J. Bot. 38: 119. 1900.
Sphagnum [unranked] *Polyclada* Warnst., Bot. Gaz. (Crawfordsville) 15: 225. 1890.

Plants small to large, brownish green, sometimes mixed with red. Capitulum dense, packed with young branches, terminal bud inconspicuous. Stems blackish, stiff and wiry when wet, brittle when dry; cortex with 2–4 layers of somewhat enlarged, rectangular, firm-walled cells. Stem leaves small, triangular-lingulate, apices rounded; margins narrowly bordered; hyaline cells efibrillose, often septate, resorbed on the outer surface, intact except near the apex on the inner surface. Branches in fascicles of 6–12 with spreading branches moderately to strongly 5-ranked; branch cortex 1-layered, efibrillose; retort cells large and single or small and stacked in pairs. Branch leaves, ovate-lanceolate, apices involute-concave; hyaline cells on the outer surface with small, strongly ringed pores toward the apex, on the inner surface with 0–3 non-ringed, inconspicuous pores at the ends and corners; green cells in cross section narrowly elliptic to truncate, equally exposed on both surfaces, end-walls thickened. Dioicous or monoicous. Spores finely papillose.

Section *Polycalda* is monotypic and contains only *S. wulfianum*.

27. *Sphagnum wulfianum* Girg., Arch. Naturk. Liv- Ehst- Kurlands, Ser. 2, Biol. Naturk. 2: 173. 1860.

Plants small to large, brownish green, sometimes mixed with red. Capitulum dense, packed with young branches, terminal bud inconspicuous. Stems blackish, stiff and wiry when wet, brittle when dry; cortex with 2–4 layers of somewhat enlarged, rectangular, firm-walled cells. Stem leaves 0.6–0.9 mm long, triangular-lingulate, apices rounded; margins narrowly bordered; hyaline cells efibrillose, often septate, resorbed on the outer surface, intact except near the apex on the inner surface. Branches in fascicles of 6–12 with spreading branches moderately to strongly 5-ranked; branch cortex 1-layered, efibrillose; retort cells large and single or small and stacked in pairs. Branch leaves 1–1.5 mm long, distinctly recurved when dry, partially erect when wet, ovate-lanceolate, apices involute-concave; hyaline cells on the outer surface with small, strongly ringed pores toward the apex, on the inner surface with 0–3 non-ringed, inconspicuous pores at the ends and corners; green cells in cross section narrowly elliptic to truncate, equally exposed on both surfaces, end-walls thickened, hyaline cells next to the green cells often faintly papillose. Dioicous or monoicous. Spores more or less 20 µm, finely papillose.

Illustrations. Crum (1984), Fig. 42; Daniels & Eddy (1985), Fig. 41.

Found in acid situations, especially in wet coniferous, mineral rich forests, the drier edges of alder and shrub thickets, and bogs. It has been know to grow on the top of decaying logs in northern swamps. *Sphagnum wulfianum* occurs in the most xerophytic habitats of any other peat moss in North America. In Maine known from Franklin (*Lorenz 8/4/1918* NY), Hancock (*Rand 8/28/1890* NY), Kennebec (*Andrus 7190* DUKE, NY), Penobscot (*Merrill 5/1899* NEBC), Somerset (Allen & Pursell, *Maine Mosses 108* DUKE, MAINE, MO, NY, US), Washington (*Worthley me-234* DUKE, MO), and York (*Gerritson 7/1901* NEBC) Counties.

Sphagnum wulfianum is different from all other Maine species of *Sphagnum* in having branches in fascicles of 6–12. As a result its capitulum is globose and the plants have a shaggy appearance. Other distinctive features of the species include a stem cortex consisting of firm-walled cells, small stem leaves that are extensively resorbed on the outer surface, branch leaves that are distinctly recurved when dry, and branch leaf hyaline cells with small, strongly ringed pores on the outer surface.

The systematic position of this species is obscure and difficult to assess, but it has been considered close to either section *Acutifolia* or section *Squarrosa*. Daniels & Eddy (1985) cited several features that *S. wulfianum* shares with Section *Acutifolia*, and most North American sphagnologists (Andrus 1980, Crum 1984) place *S. wulfianum* near section *Acutifolia*. The strongest support for that view is the presence in *S. warnstorfii* and *S. wulfianum* of small, strongly ringed pores on the outer surface of the branch leaf hyaline cells.

Sphagnum wulfianum has several features in common with section *Squarrosa*. The branch leaves of both groups are distinctively recurved when dry. The stem leaves of *S. wulfianum*, although much smaller, are similar in shape to those of *S. teres*. Furthermore, in *S. squarrosum*, *S. teres*, and *S. wulfianum* the branch leaf hyaline cells opposite the green cells are finely papillose. On balance we think *S. wulfianum* should be positioned closer to section *Squarrosa* than section *Acutifolia*.

9. *Sphagnum* section *Acutifolia* Wils., Bryol. Brit. 20. 1855.

Plants small to medium-sized, slender, rarely robust in red, brown to blackish, or green, cushions, hummocks or mats. Capitulum usually well-developed, flat-topped, hemispherical or spherical, often 5-ranked. Stem cortex with 2–4 layers of inflated, thin-walled cells, efibrillose, sometimes porose near the upper end. Stem leaves rarely less than 1 mm long, usually as long as the branch leaves, hemi-isophyllous to strongly heterophyllous, variable in shape (often on the same plant or clump), ovate- to oblong-lingulate; apices obtuse to rounded, sometimes spatulate, fimbriate or lacerate; margins bordered by linear cells, border often abruptly widened below; hyaline cells with or without pores and fibrils on the outer surface. Branch cortex efibrillose; retort cells with strong, generally prominent necks. Branch leaves erect to erect- spreading, rarely squarrose, typically more than 1 mm long, ovate-lanceolate, involute near apex; hyaline cells on the outer surface moderately porose, on the inner surface with few pores, in cross section usually strongly convex on the outer surface, sometimes strongly convex on both surfaces; green cells in cross section triangular to trapezoidal more greatly exposed on the inner surface. Dioicous. Spores more or less 28 µm, finely to coarsely papillose.

Many of the species in section *Acutifolia* have red colors that range from light pink to brilliant or dark, purplish red. The red color can occur throughout the plant or in streaks or specks, and often is restricted to the capitulum or the antheridial branches. It is not uncommon to find entirely reddish plants intermixed with yellowish green plants. A few species of section *Acutifolia* are never reddish but rather light to dark brownish in color.

All members of section *Acutifolia* have triangular or trapezoidal green cells in cross section that are exposed either exclusively on the inner surface, or on both surfaces with greater exposure on the inner surface. This type of green cell is similar to the green cells seen in section *Sphagnum*. The species of section *Sphagnum* have branch leaves with resorption furrows, and while most species of section *Acutifolia* lack resorption furrows, there is one species (*S. molle*) with this feature. These similarities have led some bryologists to place sections *Acutifolia* and *Sphagnum* beside or quite near each other (Dixon 1924, Nyholm 1969, Hill 1978, Daniels & Eddy 1985). We have chosen, however, to follow Andrews (1913) and Crum (1984) in placing the two sections at oppposite ends of our intrageneric classification. The two sections differ in the cortical cells of their branches and stems: in section *Sphagnum* they are fibrillose, while those in section *Acutifolia* are efibrillose.

1. Stem leaves broadly lacerate-fringed across the apex, and with a conspicuous triangle of enlarged, thick-walled, highly resorbed hyaline cells in the center of the leaf base 2
1. Stem leaves not lacerate-fringed, at times somewhat erose at the apex, median basal hyaline leaf cells not or only slightly enlarged, thick-walled, and resorbed 3
    2. Stem leaves fan-shaped, lacerate-fringed around almost all of the expanded upper part, usually about as wide as long; stem terminal bud greatly enlarged .... 42. *S. fimbriatum*
    2. Stem leaves lingulate, fringed only across the moderately expanded apex,, usually longer than wide; stem terminal bud only slightly enlarged .... 41. *S. girgensohnii*

3. Branch leaves with resorption furrow on outermost edge, margins denticulate .... 28. *S. molle*
3. Branch leaves without a resorption furrow, margins entire 4
    4. Stem leaves more or less flat; apices rounded or broadly truncate 5
    4. Stem leaves concave, apices involute-pointed, acute or obtuse, but not rounded 9
5. Stem leaves lingulate to spatulate, widest above the middle; branch leaves with numerous coarse teeth across a broadly rounded-truncate apex .... 29. *S. angermanicum*
5. Stem leaves more or less straight-sided or slightly narrower in the middle; branch leaves with a few fine teeth across a narrow, involute apex 6
    6. Stem cortical cells porose (occasional to many); stem leaves more or less erose at the apex, hyaline cells undivided ... 40. *S. russowii*
    6. Stem cortical cells aporose; stem leaves not erose, hyaline cells divided 7
7. Apical branch leaf hyaline cells with tiny, strongly ringed pores on the outer surface .... 32. *S. warnstorfii*
7. Apical branch leaf hyaline cells with small to moderate-sized, unringed pores on the outer surface 8
    8. Plants greenish brown to blackish; stem wood cylinder brown to black .... 33. *S. fuscum*
    8. Plants green, often pink or red; stem wood cylinder greenish to reddish .... 36. *S. rubellum*
9. Stem leaves 0.9–1.2 mm long, broadly triangular to triangular-lingulate, margins strongly bordered at base 10
9. Stem leaves more than 1.2 mm long, variously shaped, but not triangular, margins moderately bordered at base 11
    10. Branch fascicles mostly with 3 spreading branches; branch leaves 5-ranked; stem cortical cells occasionally porose (pores at times difficult to find) .... 39. *S. quinquefarium*
    10. Branch fascicles with 2 spreading branches; branch leaves not or obscurely ranked; stem cortical cells aporose .... 35. *S. subtile*
11. Branch leaf hyaline cells in cross section slightly convex on the inner surface, the convexity on the outer surface less than one-half the cell diameter 12
11. Branch leaf hyaline cells in cross section greatly convex on the inner surface, the convexity on the outer surface more than one half the cell diameter 13
    12. Branch leaves distinctly 5-ranked in straight rows; hyaline cells toward the apex with at least a few small, ringed pores; stem leaf hyaline cells lightly fibrillose above; capitulum strongly 5-parted; branch cortex retort cells with inconspicuous necks .... 37. *S. bartlettianum*

12. Branch leaves not or rarely ranked; hyaline cells toward the apex with moderate-sized, elliptic pores; stem leaf hyaline cells generally fibrillose in the upper third; capitulum hemispheric and crowded; branch cortex retort cells with conspicuous necks .... 34. *S. capillifolium*

13. Upper branch leaf margins strongly involute; apex narrow, short-pointed, weakly toothed; stem leaves 1.0–1.6 mm long .... 31. *S. subfulvum*

13. Upper branch leaf margins weakly involute; apex narrowly truncate, strongly toothed apex; stem leaves 1.5–2.0 mm long 14

14. Stem cortex with a few scattered pores; stem leaf hyaline cells sometimes weakly fibrillose near the apex, otherwise efibrillose and aporose .... 30. *S. flavicomans*

14. Stem cortex aporose; stem leaf hyaline cells fibrillose and porose in the upper one-half or more of the leaf .... 38. *S. tenerum*

28. *Sphagnum molle* Sull., Musci Allegh. no. 205. 1845 [1846].
Sphagnum tabulare Sull., Musci Allegh. no. 49. 1845 [1846].

Plants medium-sized, in whitish to yellowish green, often pink to dark red, typically compact mats. Capitulum flat to hemispherical, rarely 5-parted. Stems yellowish; stem cortex efibrillose and aporose. Stem leaves 2.0–2.5 mm long, oblong, tapered in the upper third to a narrow point; margins bordered, border only slightly broadened at base; hyaline cells normally aporose, sometimes with fibrils toward the apices, often 1-divided. Branch fascicles with 2 spreading branches; branch cortex efibrillose, retort cells with neck moderately developed, often stacked in 2's or 3's. Branch leaves spreading to almost squarrose, relatively broad, broadly tapering to a strongly involute-concave, truncate apex; margins denticulate due to resorption furrows; hyaline cells on the outer surface with narrowly elliptic pores along the commissures, on the inner surface with few or no pores, large membrane gaps sometimes present at base; hyaline cells in cross section strongly convex on the outer surface, the convexity half the cell diameter, less convex on the inner surface; green cells in cross section more or less equilateral-triangular more broadly exposed on the inner surface. Monoicous or dioicous. Spores more or less 30 μm, nearly smooth.

Illustrations. Crum (1984), Figs. 43 & 55f.

A weakly minerotrophic and hydrophytic species, occurring in poor fens, sandy areas, and less commonly in swamps. In Maine known from Cumberland (*Norton 65* DUKE) County.

Sphagnum molle differs from all other members of section *Acutifolia* in having branch leaves with marginal resorption furrows. As a result of this feature its branch leaves are denticulate on the upper margins. The presence of branch leaf resorption furrows is a character that is generally associated with section

Sphagnum, but there seems to be no doubt that *S. molle* belongs in section *Acutifolia* since it has the general aspect of the members of section *Acutifolia,* and possesses all of the other characters associated with the section. The branch leaf green cells in sections *Sphagnum* and *Acutifolia* have greater exposure on the inner face, and this has prompted some sphagnologists to place them close together (see *e.g.*, Daniels & Eddy 1985). There are striking differences between the two sections, such as the presence of fibrillose stem and branch cortical cells in section *Sphagnum*, and we have chosen not to follow this arrangement.

Sphagnum molle could be mistaken in the field for *S. compactum* since both species have variously squarrose branch leaves, but the stem leaves of *S. molle* are much larger (2.0–2.5 mm long) than those of *S. compactum* (0.4–1 mm long). It is exceedingly difficult to separate forms of *S. tenerum* from *S. molle* without a microscope.

29. *Sphagnum angermanicum* Melin, Svensk Bot. Tidskr. 13: 21. 1919.

Plants medium-sized, soft, pale and lax, white, or light green, sometimes light pink to purplish, often somewhat shiny when dry. Capitulum large with branches blunt and flattened, terminal bud evident, usually darker than the surrounding branches. Stems pale green or somewhat darkened; cortex generally aporose or occasionally with a single large pore or membrane thinning at the cell end; wood cylinder greenish or somewhat purplish. Stem leaves almost flat, 1.5–2.5 mm long, lingulate to spatulate, widest at or slightly above the middle; apex broad or rounded-truncate, toothed all around; margins bordered, border weakly broadened at base; hyaline cells strongly fibrillose toward the apex, rarely throughout, 1-septate or more. Branch fascicles with 2 spreading branches; branch cortex retort cells with very inconspicuous necks. Branch leaves erect, about the same size as the stem leaves, oblong-ovate to elliptic, not 5-ranked; apices broad, truncate, and toothed; margins weakly involute; hyaline cells on the outer surface with elliptic, ringed, commissural pores, on the inner surface with 1–3 large, round non-ringed pores, in cross section strongly convex on the outer surface, mildly convex on the inner surface; green cells in cross section triangular to somewhat trapezoidal, more broadly exposed on the inner surface. Dioicous. Spores more or less 30 μm, nearly smooth.

Illustrations. Crum (1984), Fig. 45; Daniels and Eddy (1985), Fig. 17.

Found principally in depressions in open bogs, poor fens, and often on stream banks along the margins of ponds. In Maine known from Aroostook (Collins 2661a NEBC), Hancock (*Rand 7/3/1891* DUKE), and Washington (*Crum 10/1991* DUKE, MO) Counties.

Sphagnum angermanicum is recognized by its large, almost flat stem leaves that are widest above the middle, and have a broad, rounded-truncate apex that can be dentate to somewhat lacerate. Plants of *S. angermanicum* are moderate-sized, soft, lax, and often have pinkish to purplish tinges. *Sphagnum flavicomans* and *S.*

angermanicum are similar in having large stem leaves. Plants of *S. flavicomans*, however, are coarse and somewhat robust plants, and its stem leaves are narrowed to more or less involute-pointed apices.

30. *Sphagnum flavicomans* (Card.) Warnst., Pflanzenr. III. (51). 79. 1911.
Sphagnum acutifolium var. *flavicomans* Card., Rev. Bryol. 11: 55. 1884.
Sphagnum plumulosum var. *flavicomans* (Card.) Andr., N. Amer. Fl. 15: 30: 1930.

Plants somewhat robust, coarse, often brown to yellow-brown. Capitulum somewhat large and dense with a cluster of branch buds, typically rounded and heavy. Stems dark; cortical cells very sparsely porose. Stem leaves 1.5–2.0 mm long, oblong-triangular, narrowed to a more or less involute-concave point, broadly apiculate or narrowly truncate; margins weakly bordered above, moderately broadened at base; hyaline cells mostly 1-divided, weakly fibrillose near apices, often with few to many membrane gaps, at base the median hyaline cells long, straight-sided, and extensively resorbed forming a conspicuous triangular area extending to mid-leaf. Branch fascicles with 2 spreading branches; branch cortex retort cells conspicuously long-necked. Branch leaves not or mildly ranked, 1.5–2.0 mm long, broadly oblong-ovate, gradually narrowed; apices more or less flat and truncate; hyaline cells on the outer surface near the apex with large pores almost as wide as the cell, at the base with a few large membrane gaps, on the inner surface with 1–2 tiny, ringed pores, usually at the cell ends near the leaf tips, in cross section strongly convex on the outer surface, moderate convex on the inner surface; green cells in cross section equilateral-triangular to trapezoidal, more broadly exposed on the inner surface. Dioicous. Spores more or less 30 μm, nearly smooth.

Illustration. Crum (1984), Fig. 46.

Found at the base and sides of hummocks, in cushions at shaded pond margins, in poor fens as well as ombrotrophic bogs, red maple swamps, rarely in areas not shaded. In Maine known from Cumberland (*Levy 7/13/1911* DUKE), Hancock (Eaton & Faxon 52 DUKE, MO, NY), Kennebec (*Andrus 7187* DUKE), Lincoln (Allen & Pursell, *Maine Mosses 3* DUKE, MAINE, MO, NY, US), Sagadahoc (*Allen 16775* DUKE, MO), Somerset (*Allen 21496* DUKE, MO), Waldo (*Norton 2* DUKE), Washington (*Crum 9/1991* DUKE, MO) and York *(W. [R]itson(?) 7/1908* DUKE) Counties.

Sphagnum flavicomans has a somewhat robust, prominent capitulum with crowded, coarse branches which give it a top-heavy appearance. The plants are characteristically yellow-brown, and often have a purplish sheen. At times they can be deep brown with the aspect of *S. fuscum*. The stems of *S. flavicomans* are dark reddish brown or sometimes deep red, and although the outer stem cortical cells have a few well-scattered pores, they are difficult to demonstrate and require much searching. The species is generally more recognizable in the field than under the microscope. It is sometimes mistaken for *S. subfulvum*, probably because of its sheen when dry; both species have prominent capitula and branch cortical retort cells with long necks. Although as noted above they are difficult to find, the stem cortical cells of *S. flavicomans* have a few pores while those *S. subfulvum* are aporose.

31. *Sphagnum subfulvum* Sjörs, Svensk Bot. Tidskr. 38: 404. 1944.

Plants medium-sized to somewhat robust, soft and lax, yellowish brown to brown, with a metallic sheen when dry, rarely with tinges of dark reddish purple, but without tinges of red. Capitulum more or less flat and 5-parted. Stems brownish to dark; cortical cells aporose. Stem leaves 1.0–1.6 mm long, mostly straight-sided, broadly obtuse to rounded, somewhat truncate or rarely a few leaves cuspidate and pinched; margins strongly bordered, border moderate to broad at base; hyaline cells efibrillose, or with occasional traces of fibrils, 1-septate. Branch cortex retort cells with prominent necks. Branch leaves not ranked, as long or longer than the stem leaves, ovate, rather abruptly narrowed to a shortly acuminate, inrolled apex; hyaline cells on the outer surface with fairly large, elliptical commissural pores near the apex becoming larger toward the base, with round pores near the margins, on the inner surface with few if any pores near the apex and with a few large pores near the leaf base, in cross section bulging convex on the outer surface, only slightly convex on the inner surface; green cells in cross section more or less equilaterally triangular to slightly trapezoidal, more greatly exposed on the inner surface. Monoicous. Spores more or less 25 µm.

Illustrations. Andrus (1980), pp. 79–80; Crum (1984), Fig. 48 a–c; Daniels & Eddy (1985), Fig. 19.

Found on pond margins, in moderately wet depressions in intermediate to rich fens, open, flat bogs, in sedge mats, and ridges in patterned fens. In Maine known from Hancock (*Rand 9/3/1891* NEBC), Penobscot (*Merrill 6/1899* NEBC), and Washington (*Collins 2618* NEBC) Counties.

Sphagnum subfulvum is difficult to define and is apt to be confused with *S. capillifolium* or *S. flavicomans*. *Sphagnum flavicomans* is a larger plant than *S. subfulvum*, it has a heavy, bushy capitulum, and less rounded stem leaves that have a triangular area of differentiated hyaline cells at the base. The branch leaves of *S. flavicomans* and *S. capillifolium* gradually taper to an acuminate apex, while those of *S. subfulvum* are more abruptly narrowed. The branch leaf hyaline cells of *S. flavicomans* toward the apex are large and central in a single row, while those of *S. subfulvum* and *S. capillifolium* are commissural.

32. *Sphagnum warnstorfii* Russ., Sitzungsber. Naturf.-Ges. Univ. Dorpat 8: 315. 1888.

Plants small, slender, generally in green to brownish green, or reddish to dark brownish (especially in sun) carpets. Capitulum usually 5-parted. Stem cortical cells in 3–

4 layers, aporose and efibrillose. Stem leaves 1.0–1.5 mm long, broadly triangular to oblong lingulate, obtuse to broad-rounded; margins bordered, border very broad at base; hyaline cells mostly without fibrils or pores, 1-septate, rarely not divided. Branch fascicles with 2 very long, spreading and 1–2 pendent branches; branch retort cells conspicuous, with prominent necks. Branch leaves distinctly 5-ranked when wet, ovate-lanceolate, involute-concave, the tips somewhat recurved when dry; hyaline cells on the outer surface in the upper ¼ of the leaf with tiny, round to elliptic, ringed pores near the commissures, pores becoming larger toward the middle and base, on the inner surface with large, round pores along the margins and at base, in cross section moderately convex on the outer surface, not or hardly convex on the inner surface; green cells in cross section triangular to trapezoidal, exclusively or more broadly exposed on the inner surface. Dioicous. Spores more or less 20 μm, finely papillose.

Illustrations. Crum (1984), Fig. 50; Daniels and Eddy (1985), Fig. 27.

A clearly defined minerotrophic species of rich fens and *Thuja* swamps, forming dark or brownish green, loose carpets or low hummocks in shade, and green to dark reddish tufts and carpets in open places. In Maine known from Aroostook (*Collins 2748b* NEBC), Cumberland (*Levy 2092* NY), Hancock *(Rand 6/18/1990* NY), Kennebec (*Andrus 7186* DUKE), Oxford (*Norton 6* DUKE), Penobscot *(Spaulding 79* DUKE), Piscataquis (*Crane 600* DUKE), Somerset (*Allen 9407* DUKE, MO), Waldo (*Lowe 9* DUKE), Washington (*Crum 10/1991* DUKE), and York (*Norton 14* DUKE) Counties.

Sphagnum warnstorfii is not easily recognized in the field because it resembles several other species of section *Acutifolia* such as *S. capillifolium*, *S. rubellum*, *S. subfulvum*, and *S. russowii*. These species, however, are not apt to be found in the types of mineral rich habitats that support *S. warnstorfii*. Microscopically *S. warnstorfii* can be recognized by its distinctive hyaline cell pores on the outer surface toward the apex of the branch leaves. These tiny, round to elliptic, strongly ringed pores are especially noticeable along the commissures.

33. *Sphagnum fuscum* (Schimp.) Klinggr., Schriften Königl. Phys.-Ökon. Ges. Königsberg 13: 4. 1872.

Sphagnum acutifolium var. ε *fuscum* Schimp., Mém. Divers. Savants Acad. Roy. Sci. Inst. Roy. France, Sci. Math. 15: 64. 1857.

Plants small and slender in compact, deep brown or blackish, sometimes rusty or greenish brown tufts or mounds. Capitulum small, flat-topped. Stems dark, reddish brown; cortical cells aporose. Stem leaves usually less than 1.3 mm long, slightly concave, longer than broad, lingulate, broadly rounded, sometimes slightly mucronate; margins strongly bordered, border much broadened at the base; hyaline cells mostly divided, usually efibrillose. Branch fascicles with 2 spreading branches; branch cortex retort cells conspicuous and long-necked. Branch leaves not or only rarely ranked, imbricate or slightly spreading, ovate-lanceolate, strongly involute at the apex; hyaline cells on the outer surface with small, generally elliptic pores near the tip, pores becoming larger toward the leaf base, on the inner surface toward the apex with only end pores, in the lower part of the leaf with large pores along the margins and at base, in cross section, greatly convex on the outer surface, not or weakly convex on the inner surface; green cells in cross section triangular or trapezoidal, exposed exclusively or more broadly on the inner surface. Dioicous. Spores more or less 25 µm, smooth or nearly so.

Illustrations. Crum (1984), Fig. 51; Daniels and Eddy (1985), Fig. 21.

Usually growing in compact hummocks, often on the top of larger hummocks, common in ombrotrophic situations, less frequently in fens and minerotrophic mires. Known in Maine from Aroostook (*Worthley 3003* MO), Franklin (*Dunham 10/1916* DUKE), Hancock (*Pedano 412* DUKE, MO), Kennebec (*Andrus 7155* DUKE), Penobscot (*Lowe 8/20/1957* DUKE), Piscataquis (*Hermann 19154* DUKE), Sagadahoc (*Allen 10181* DUKE, MO), Waldo (*Norton 22* DUKE), and Washington (*Crum 9/1991* MO) Counties.

Sphagnum fuscum can generally be recognized in the field by its brown, reddish brown or purplish capitulum, and compact growth habit. *Sphagnum fuscum* and *S. rubellum* are similar in having lingulate stem leaves that are broadly rounded at the apex, but *S. rubellum* is never brown-colored. *Sphagnum subfulvum* is often light brownish, and so could be confused with *S. fuscum*. Plants of *S. subfulvum*, however, are never reddish, its stem leaves generally have pinched instead of rounded apices, and its branch leaves have a noticeable sheen when dry.

34. *Sphagnum capillifolium* (Ehrh.) Hedw., Fund. Hist. Nat. Musc. Frond. 2: 86. 1782.
Sphagnum palustre var. *capillifolium* Ehrh., Hannover. Mag. 18: 235. 1780.
? *Sphagnum nemoreum* Scop., Fl. Carniol. (ed. 2) 2: 305. 1772.
Sphagnum palustre var. *capillaceum* Weiss., Pl. Crypt. Fl. Gott. 265. 1769.
Sphagnum capillaceum (Weiss.) Schrank, Baier. Fl. 2: 435. 1789.

Plants slender, small and compact or moderate-sized and loose, green to full-red, mottled reddish or pink. Capitulum small, neatly hemispherical. Stems green, yellowish or red; cortical cells aporose. Stem leaves 1.2–1.8 mm long, oblong-ovate to lingulate-triangular, more or less involute-pointed at apices; margins bordered, upper border weak, not much broadened at base; hyaline cells nearly always fibrillose and porose toward the apex, sometimes with large leaf gaps, 0–1 septate. Branch fascicles with 2 spreading and 1–2 pendent branches, branch cortex retort cells with well-developed necks. Branch leaves not or rarely ranked, straight, imbricate or slightly spreading, narrowly ovate-lanceolate, strongly involute-pointed at apex; hyaline cells on the outer surface with elliptic, ringed, commissural pores, on the inner surface with cell end pores, and large circular pores along the lower margins and at leaf bases, in cross section strongly convex on the outer surface, less so on the inner surface; green cells in cross section triangular to trapezoidal, more broadly exposed on the inner surface. Dioicous. Spores more or less 25 µm, smooth.

Illustration. Crum (1984), Fig. 52.

Very common in ombrotrophic situations, often in compact cushions, dense mats, or carpets on wet, acidic rocks and the sides and tops of hummocks in boggy areas. In Maine known from Aroostook (*Allen 16329* DUKE, MO), Cumberland (*Allen 20924* DUKE, MO), Franklin (*Dunham 10/1909* DUKE), Hancock (*Pedano 501* DUKE, MO), Kennebec (*Andrus 7168* NY), Lincoln (Allen & Pursell, *Maine Mosses 1* DUKE, MAINE, MO, NY, US), Oxford (*Allen 20964* DUKE, MO), Penobscot (*Lowe 9/20/1957* DUKE), Piscataquis (*Pursell 12030* DUKE, MO), Sagadohoc (*Allen 16784* DUKE, MO), Washington (*Pedano 313* DUKE, MO), and York (*Redfearn 37828* DUKE, MO) Counties.

Sphagnum capillifolium is a widespread and exceedingly variable species. Its taxonomic limits are notoriously difficult to define. There is little doubt, however, that some of its variants are genetically distinct (McQueen 1989), but sphagnologists are not in agreement as to whether the variants should be treated as species, varieties or synonyms. Andrus (1980) recognized three Maine segregates of *S. capillifolium* at the species level: *S. subtile*, *S. rubellum*, and *S. andersonianum*. Crum (1984), on the other hand, placed *S. rubellum* and *S. subtile* into the synonymy of *S. capillifolium* var. *tenellum* (Schimp.) Crum. Daniels and Eddy (1985) also reduced *S. rubellum* to a variety of *S. capillifolium*, but as *S. capillifolium* var. *rubellum* (a later name at the varietal level than *tenellum*). Despite the difficulties in separating these taxa, we have elected to recognize *S. rubellum* and *S. subtile* at the species level, and synonymize *S. andersonianum* with *S. rubellum.*

Sphagnum capillifolium s. str. has relatively long (more than 1.2 mm long), lingulate, generally straight-sided stem leaves that taper to concave-pointed, more or less involute apices. Its stem leaves are weakly bordered with the border not much broadened at base. The stem leaf hyaline cells are variously fibrillose, porose, and sometimes have numerous oblong, thin-walled membrane gaps, especially toward the apex. In addition, its branch leaves are not in distinct rows, and its spores are smooth.

35. *Sphagnum subtile* (Russ.) Warnst., Krypt.-Fl. Brandenburg, Leber- & Torfm. 1(3): 409. 1903.

Sphagnum acutifolium var. *subtile* Russ., Arch. Naturk. Liv- Ehst- Kurlands, Ser. 2, Biol. Naturk. 10: 509. 1894.

Plants slender, small to moderate-sized, green to mottled with red or pink. Capitulum normally flat, 5-parted, sometimes round. Stem cortical cells aporose. Stem leaves about 1.0 mm long, triangular to oblong-lingulate, acute to somewhat rounded at apex, border strong throughout and conspicuously broadened at base; hyaline cells mostly not divided, occasionally with a few fibrils toward the apex, pores and leaf gaps absent. Branch fascicles with 2 spreading branches; branch cortex retort cells with inconspicuous necks. Branch leaves rarely obscurely ranked, less than 1.3 mm long, broadly ovate-lanceolate, margins involute near apex; hyaline cells with numerous round to elliptic, ringed pores on the outer surface, pores grading from moderate-sized at the apex to large pores or leaf gaps at the base, in cross section strongly convex on the outer surface, slightly convex on the inner surface; green cells in cross section triangular to trapezoidal more broadly or exclusively exposed on the inner surface. Dioicous. Spores more or less 25 µm, finely papillose.

Illustration. Andrus (1980), p. 72.

In coniferous forests, ombrotrophic mires, and poor fens; forming low hummocks, and small cushions. In Maine known from Androscoggin (*Allen 22485* DUKE, MO), Cumberland (*Norton 60* DUKE), Hancock (*Rand 924* NY), Kennebec (*Andrus 7182* DUKE, NY), Lincoln (*Allen 21099* DUKE, MO), Oxford (*O.D. Allen 34* MO), Somerset (*Pursell 11962* DUKE, MO), Washington (*Pedano 516* DUKE, MO), and York (*Redfearn 37836* DUKE, MO) Counties.

Sphagnum subtile is best distinguished from *S. capillifolium* by stem leaf features. Its leaves are short (less than 1.2 mm long), triangular to semi-lingulate, and acute to somewhat rounded at the apex. They are strongly bordered throughout and the border is very much broadened at the leaf base. The stem leaf hyaline cells are aporose with only a few fibrillose cells toward the apex. In contrast the stem leaves of *S. capillifolium* are mostly longer than 1.2 mm, the basal leaf border is weakly developed, and its upper hyaline cells are nearly always fibrillose with few to many pores or membrane gaps on the outer surface.

Crum (1984) merged *S. subtile* with *S. rubellum* (as *S. capillifolium* var. *tenellum*) because of the tendency of its stem leaves to have rounded apices and to be "not very strongly bordered at base." Although we agree there is a slight tendency toward round apices in the stem leaves of *S. subtile*, the stem leaves of *S. subtile* in Maine are strongly bordered. Furthermore, in *S. subtile* the branch leaf hyaline cells toward the apices lack the small, round to elliptic pores characteristic of *S. rubellum*. For these reason we feel *S. subtile* deserves specific rank.

36. *Sphagnum rubellum* Wils., Bryol. Brit. 19. 1855.

Sphagnum acutifolium var. *tenellum* Schimp., Mém. Hist. Nat. Sphaignes 63. 1857.

Sphagnum capillifolium var. *tenellum* (Schimp.) Crum, Contr. Univ. Mich. Herb. 11: 90. 1975.

Sphagnum capillifolium var. *rubellum* (Wils.) Eddy *in* Daniels & Eddy, Handb. Eur. Sphagna 96. 1985.

Sphagnum andersonianum Andrus, Bryologist 83: 60. 1980.

Plants slender, generally pink or red, sometimes mottled red. Capitulum flat-topped, 5-parted with young branches more or less upturned. Stems red, green or yellowish; cortical cells aporose. Stem leaves 1–1.25 mm long, more or less flat, oblong to lingulate, usually straight-sided with broadly rounded apices, some leaves usually broadly acute; margins bordered, border strongly broadened at base; hyaline cells mostly 2–3-divided, normally efibrillose, but sometimes fibrillose in the upper ¼. Branch fascicles with 2 spreading branches. Branch leaves noticeably 5-ranked, especially when wet, less than 1.2 mm long, ovate-lanceolate, somewhat secund on some branches, margins involute above; hyaline cells on the outer surface with numerous small round to elliptic pores, becoming gradually larger and round toward the base, on the inner surface with few or no pores; green cells in cross section triangular to slightly trapezoidal, exposed more broadly on the inner surface. Monoicous or dioicous. Spores more or less 25 μm, finely granulose.

Illustrations. Crum (1984), Fig. 53a–c; Daniels & Eddy (1985), Fig. 25ii.

Forming hummocks and carpets, mostly in ombrotrophic bogs. In Maine known from Aroostook (*Collins 2661* NEBC), Androscoggin (*Allen 22469* DUKE, MO), Cumberland (*Allen 20935* DUKE, MO), Franklin (*Collins* NEBC), Hancock (*Andrus 6653* DUKE, NY), Kennebec (*Andrus 7197* DUKE), Lincoln (*Allen 1295* MO, NY), Penobscot (*Merrill 18/1898* NEBC), Piscataquis (*Merrill 11/5/1898* NEBC), Sagadahoc (*Andrus 7162* DUKE), Somerset (*Collins 7/26/1903* NEBC), and Washington (*Crum 9/1991* DUKE, MO) Counties.

Sphagnum rubellum is generally pink, red, or mottled-red, and in characteristic form can be recognized by its flat, oblong-lingulate stem leaves that have rounded apices, distinctly 5-ranked branch leaves, and branch leaf hyaline cells with numerous small, round or elliptic pores on the outer surfaces. In this species the branch hyaline cell pores gradually become larger toward the base. The stem leaves of *S. rubellum*, however, can be exceedingly variable in shape, length, and degree of roundness. Indeed, the stem leaf apices in this species can be clearly round, or tapered to blunt points. *Sphagnum subtile* and *S. rubellum* have similar stem leaves in terms of size and the development of a strong basal leaf border. The stem leaves of *S. subtile*, however, are acute to somewhat rounded. Even though acute and rounded stem leaf apices can often be found on the same stem in both species in *S. subtile* acute apices predominate, while in *S. rubellum* rounded apices predominate. Only rarely is it difficult to make a decision between the two species. *Sphagnum rubellum* differs from *S. capillifolium* in having stem leaves with strongly developed basal marginal borders, distinctly 5-ranked branch leaves and branch leaf hyaline cells with small, round or elliptic apical pores on the outer surface.

37. *Sphagnum bartlettianum* Warnst., Pflanzenr. III (51). 105. 1911.

Plants often pink, dark red, mottled-red, or uniformly green in relatively compact, deep cushions or occasionally loose mats. Capitulum more or less flat to slightly rounded, distinctly 5-parted. Stems green to red, sometimes dark-red. Stem leaves to 2.0 mm long, narrowly lingulate-triangular, more or less straight-sided, apices tapered, acute, concave to almost flat; margins bordered, border narrow above and only slightly broadened at base; hyaline cells 1–2 divided, lightly fibrillose above, sometimes with a few membrane gaps. Branch fascicles with 2, usually long-tapered, spreading branches, and 1–2 pendent branches that are often difficult to distinguish from spreading branches; branch cortex retort cells large, necks weakly developed. Branch leaves distinctly 5-ranked in straight rows, lanceolate, margins strongly involute near apex; hyaline cells in cross section strongly convex on the outer surface, weakly convex on the inner surface, on the outer surface toward the apex with numerous (3–9) small, round to elliptic, strongly ringed commissural pores, that become larger and more numerous toward the base and round along the margins, inner surface aporose; green cells in cross section triangular to trapezoidal, more broadly exposed on the inner surface. Dioicous. Spores 25 µm, coarsely papillose.

Illustration. Crum & Anderson (1981), Fig. 21 O–R.

Found in minerotrophic and boreal, poor fens, it is more abundant southward along the Atlantic Coast and in the Appalachian Mountains. In Maine known from Hancock (*Senter 9a* BING) County.

Sphagnum bartlettianum is distinguished from *S. capillifolium* by the presence on the branch leaf hyaline cells of numerous (3–9) small, round to elliptic, strongly ringed commissural pores. These pores are found on the outer surface of the branch leaves near the apex. The stem leaves of *S. bartlettianum* are long and relatively narrow with usually concave, acute apices. *Sphagnum warnstorfii* also has small, ringed pores on its branch leaf hyaline cells, and this can cause the two to be confused. *Sphagnum warnstorfii* differs from *S. bartlettianum* in having stem leaves that are more rounded at the apex and more straight-sided.

38. *Sphagnum tenerum* Sull. & Lesq. *ex* Sull. *in* Gray, Man. (ed. 2) 611. 1856
Sphagnum nemoreum var. *tenerum* (Sull. & Lesq.) Nyh., Ill. Moss Fl. Fennoscandia. II. Musci. 725. 1969.
Sphagnum capillaceum var. *tenerum* (Sull. & Lesq.) Crum, Bryologist 74: 168. 1971.
Sphagnum capillifolium var. *tenerum* (Sull. & Lesq.) Crum, Contr. Univ. Michigan Herb. 11: 90. 1975.

Plants whitish to yellowish and often reddish or tinged with pink or red, in compact, slender to robust mounds or clumps. Capitulum usually densely crowded, hemispherical, with short, blunt branches. Stems yellowish green to light pink; cortical cells aporose. Stem leaves more than 1.3 mm long, elongate-triangular, more or less straight-sided, tapering to a bluntly pointed, involute apex, appearing to be hemi-isophyllous; hyaline cells fibrillose and porose, 0–1 divided; margins bordered, border nrrow above, not much widened at base. Branch fascicles crowded, with 2 spreading branches; branch cortex with conspiculous retort cells, neck prominent. Branch leaves crowded, not in rows, about as large as stem leaves, margins weakly involute, relatively broad-pointed; hyaline cells on the outer surface with rows of elliptic pores along the commissures, on the inner surface with large pores throughout; in cross section hyaline cells greatly convex on the inner surface and slightly less so on the inner surface. Green cells in cross section narrowly triangular to trapezoidal or somewhat ellipsoid, more broadly exposed on the inner surface, appearing small in contrast to the large hyaline cells convexities. Monoicous and dioicous. Spores more or less 25 µm, nearly smooth.

On wet or damp sand around pool margins, Jack pine-spruce woods and coastal peatland. In Maine known from Hancock (*Senter 13* NY) and Washington (*Leonardi 287* NYS) Counties.

Illustrations. Crum (1975), Fig. 3 a–c. Crum & Anderson (1981, Fig. 21 I–N.

Sphagnum tenerum can easily be confused with the much more common *S. capillifolium*. Both species have varying degrees of hemi-isophylly in which the stem leaves tend to resemble branch leaves in shape, structure, and especially in number of fibrils, pores, and membrane gaps. *Sphagnum tenerum* has more or less crowded branch fascicles throughout the stem, and hemispherical capitula. Its branch leaves are rather turgid, tightly imbricate, ovate, and somewhat blunt, with weakly involute, rather strongly toothed margins. The branch leaf hyaline cells of *S. tenerum* have large, round pores on the outer surface, and in cross section their free convexity on the outer surface is usually ½ or more the cell diameter and on the inner surface usually at least ¼ the cell diameter.

In *S. capillifolium* the branch fascicles are less crowded than those of *S. tenerum*, and usually its stem leaves are exposed. The capitulum is convex and dainty (Crum 1984), with branch leaves somewhat spreading, not turgid, scarcely imbricate, ovate-lanceolate, and involute pointed. The free convexity of its branch leaf hyaline cells in cross section on the outer surface is usually less than ½ their diameter and on the inner surface much less than ¼ their diameter.

39. *Sphagnum quinquefarium* (Lindb. *ex* Braithw.) Warnst., Hedwigia 25: 222. 1886.

Sphagnum acutifolium var. ζ *quinquefarium* Lindb. *ex* Braithw., Sphagnac. Eur. 71. 1878.

Plants slender to medium-sized, light-green to whitish, yellowish or tinged with pink to red, sometimes in deep cushions. Stems greenish yellow; most cortical cells aporose, but a few with single pores or inconspicuous pore thinnings that require heavy staining to see. Stem leaves 1.0–1.3 mm long, nearly as broad as long, generally oblong-triangular to oblong-ovate, tapering to a short, concave point; margins broadly bordered above and very broadly bordered below; hyaline cells undivided or 1–2 divided, occasionally with large membrane gaps near the apex, efibrillose except for traces near the apex, central basal cells not noticeably enlarged or resorbed in a sieve-like area. Branch fascicles with 3 spreading and 1–2 pendent branches; branch cortex with conspicuous retort cells. Branch leaves strongly 5-ranked, rarely weakly ranked, 1.0–1.4 mm long, ovate-lanceolate; hyaline cells on the outer surface with numerous medium-sized, round to elliptic, strongly ringed commissural pores, on the inner surface with small unringed pores at the upper and lower ends near the apex; green cells in cross section triangular to trapezoidal, more broadly exposed on the inner surface. Monoicous or dioicous. Spores more or less 24 μm, nearly smooth.

Illustrations. Crum (1984), Fig. 58; Daniels & Eddy (1985), Fig. 23.

Typically montane in coniferous forests where it forms compact cushions and carpets, especially on rocks in seepage areas and moist humus in wooded areas, rarely on swamp and bog margins. In Maine known from Cumberland (*Allen 21242* DUKE, MO), Franklin (*Allen 22673* DUKE, MO), Hancock (*Magill 11805* DUKE, MO), Oxford (Allen & Pursell, *Maine Mosses 7* DUKE, MAINE, MO, NY, US), Piscataquis (Allen & Pursell, *Maine Mosses 106* DUKE, MAINE, MO, NY, US), Somerset (*Allen 9425* DUKE, MO), and Washington (*Pursell 12145* DUKE, MAINE, MO, NY, US) Counties.

Sphagnum quinquefarium has short, triangular-lingulate stem leaves (usually less than 1.4 mm long), that are broadly bordered above and especially broadly bordered at base. At least some of its branch fascicles have 3 spreading branches, and the branch leaves are generally 5-ranked. The other Maine members of section *Acutifolia* normally have only 2 spreading branches in their branch fascicles. The outer stem cortical cells in *S. quinquefarium* nearly always have few to many pores, but in order to see the pores the stems must be heavily stained and the cortical cells carefully searched. *Sphagnum quinquefarium* could be mistaken for *S. subtile*, since both species have strikingly similar stem leaves. *Sphagnum subtile* differs from *S. quinquefarium* in having branch fascicles with only 2 spreading branches, and aporose stem cortical cells.

40. *Sphagnum russowii* Warnst., Hedwigia 25: 225. 1886.
Sphagnum acutifolium var. *robustum* Warnst., Flora: 67: 501. 1884.
Sphagnum robustum (Warnst.) Röll, Flora 69: 109. 1886.

Plants medium-sized to slender or delicate, sometimes stiff, green, often red-tinged, especially the antheridial buds. Capitulum flat-topped, 5-parted, branches more or less coarse and blunt. Stem cortical cells often having a single pore, sometimes relatively few cortical cells with pores. Stem leaves about 1.5 mm long, relatively flat, broadly oblong-lingulate, with a broadly pointed to rounded, sometimes notched or somewhat erose apex; margins strongly bordered, especially at the base; hyaline cells mostly undivided, toward the apex short and sinusoid, at the middle of the base somewhat enlarged, but not forming a sieve-like meshwork. Branch leaves about as long as the stem leaves, ovate lanceolate, margins strongly involute near the apex; hyaline cells on the outer surface with numerous elliptic, ringed, commissural pores, on the inner surface largely resorbed with large, round pores throughout, in cross section the outer surface greatly convex; green cells in cross section triangular to trapezoidal, more broadly exposed on the inner surface. Monoicous or dioicous. Spores more or less 25 µm, nearly smooth.

Illustrations. Crum (1984), Fig. 59; Daniels & Eddy (1985), Fig. 29.

On the margins of open mires, in coniferous (especially spruce-fir) and *Thuja* forests, and on rocks in seepage in mountainous areas. In Maine known from Androscoggin (*Allen 21762* DUKE, MO), Aroostook (*Allen 16466* DUKE, MO), Cumberland (*Allen 15937* DUKE, MO), Franklin (*Allen 15812* DUKE, MO), Hancock (*Pedano 498* DUKE), Kennebec (*Andrus 7189* DUKE, NY), Knox (*Allen & Allen 6075* MO), Lincoln (*Allen 1341* DUKE, MO, NY), Oxford (*Allen 22520* DUKE, MO), Piscataquis (*Crane 594* DUKE), Somerset (Allen & Pursell, *Maine Mosses 107* DUKE, MAINE, MO, NY, US), Waldo (*Solomon 20175* DUKE, MO), and Washington (*Pedano 595* DUKE, MO) Counties.

The stem leaves of *S. russowii* are quite similar to those of *S. rubellum*; both are lingulate with rounded apices, and they are strongly bordered on both the upper and lower margins. In *S. russowii*, however, the stem leaves differ from those of *S. rubellum* in often having more or less erose apices, short, sinusoid hyaline cells near the apex, and a suggestion of hyaline cell enlargment at the middle of the leaf base. Also, most of the outer cells of the stem cortex in *S. russowii* have single, round pores, and the branch leaves are not 5-ranked. In *S. rubellum* the stem cortical cells lack pores and the branch leaves are 5-ranked. *Sphagnum russowii* at times exhibits degrees of isophylly, as do all peat mosses, in which the stem leaves are variously pointed, and the hyaline cells have numerous elliptic, ringed commissural pores on the outer surface. Such forms can be puzzling.

At times collections of *S. girgensohniii* have stem leaves that are less lacerate at the apex than usual and these leaves tend to resemble the stem leaves of *S. russowii*. The stems in both species have porose outer cortical cells, but in *S. girgensohnii* usually every cortical cell is porose, while in *S. russowii* only occasional cells or groups of cells are porose. Furthermore, *S. russowii* often has a pinkish tinge, and the apical stem leaf hyaline cells are sinuoid-rhombic. Plants of *S. girgensohnii* are never reddish and the apical stem leaf hyaline cells are more nearly rhombic with less curved sides.

41. *Sphagnum girgensohnii* Russ., Beitr. Torfm. 46. 1865.

Plants medium-sized to somewhat robust, sometimes tall, slender and stiff, green to brownish, never reddish. Capitulum large, 5-parted and flat-topped. Stems green to light brown, cortical cells enlarged, thin-walled and more or less quadrate, each with a single, large, round pore at the middle or upper end. Stem leaves 0.8–1.3 mm long, broadly lingulate to somewhat spatulate, apex broadly truncate, and short-lacerate across the top; margins strongly bordered, border abruptly and greatly expanded at the base; hyaline cells rhomboidal above, efibrillose, mostly undivided, becoming longer and more or less straight below, with a conspicuous triangular area of enlarged cells at mid-base. Branch cortex retort cells with inconspicuous necks. Branch leaves not 5-ranked, 1.0–1.6 mm long, broadly ovate, margins strongly inrolled near the apex; hyaline cells on the outer surface with numerous, ringed pores, on the inner surface with 3–5 large, unringed, round pores that are almost as wide as the cells; green cells in cross section triangular to trapezoidal more broadly exposed on the inner surface. Dioicous or monoicous. Spores more or less 25 μm, nearly smooth.

Illustrations. Crum (1984), Fig. 60; Daniels & Eddy (1985), Fig. 31.

A shade-tolerant species found on the drier margins of boggy forests or swampy areas of coniferous or hardwood forests, along stream banks and at high elevations. In Maine known from Androscoggin (*Allen 22490* DUKE, MO), Aroostook (*Worthley me-173* DUKE, MO), Cumberland (*Allen 15921* DUKE, MO), Franklin (*Pursell & Allen 11153* DUKE, MO), Hancock (*Redfearn 37754* DUKE, MO), Kennebec (*Redfearn 37807* MO), Knox (*Allen & Allen 6073* MO), Lincoln (*Allen 21090* DUKE, MO), Oxford (Allen & Pursell, *Maine Mosses 4* DUKE, MAINE, MO, NY, US), Piscataquis (*Pursell 12029* DUKE, MO), Somerset (*Allen 21468* DUKE, MO), Waldo (*Norton 15* DUKE), and Washington (*Pedano 609* DUKE, MO) Counties.

Sphagnum girgensohnii and *S. fimbriatum* are distinguished from all other species of section *Acutifolia* by the unique shape of their stem leaves. The stem leaves of *S. girgensohnii* are broadly lingulate and generally short-lacerate across a broadly truncate apex. The lacerations in *S. girgensohnii* do not extend very far down the sides of the stem leaves. The stem leaves of *S. fimbriatum* are broadly and shortly spatulate (narrowest near the leaf insertion) with widely rounded, lacerated apices. The lacerations in *S. fimbriatum* extend around the entire upper sides of the stem leaves.

At times stem leaves of *S. girgensohniii* are encountered that are less lacerate at the apex than usual and these leaves tend to resemble those of *S. russowii*, which has a rounded stem leaf apex that can be slightly erose. The stems in both species have porose outer cortical cells, but in *S. girgensohnii* every cortical cell is porose, while in *S. russowii* only occasional cells or groups of cells are porose. Furthermore, *S. russowii* often has a pinkish tinge, and the apical stem leaf hyaline cells are sinuoid-rhombic. Plants of *S. girgensohnii* are never reddish and the apical stem leaf hyaline cells are more nearly rhombic with less curved sides. The terminal bud in the capitulum of *S. girgensohnii* is somewhat enlarged, and noticable because it projects above the other buds. This feature in *S. girgensohnii*, however, is not nearly as well-developed as it is in *S. fimbriatum* where it is especially large and conspicuous because it protrudes above the other buds.

42. *Sphagnum fimbriatum* Wils. *ex* Wils. & Hook. *in* Hook., Fl. Antarct. 398. 1847.

Plants small and slender, often in deep cushions, pale-green to straw-colored, never red. Capitulum small, 5-parted, with a large, conspicuous terminal bud. Stems green to straw-colored, cortical cells each with a single large, rounded pore at the upper end, rarely with 2 pores. Stem leaves large, broadly and shortly spatulate, often broader than long, lacerate-fringed due to resorption across a broadly truncate apex and down the upper sides of the leaves; hyaline cells mostly divided, at mid-base forming a conspicuous triangular patch of enlarged, long, straight-sided cells. Branch leaves imbricate, not 5-ranked, generally less than 1.5 mm long, narrowly ovate, involute-concave; hyaline cells on the outer surface with numerous commissural pores grading from small near the apices to large at the base, on the inner surface with a single row of large, round, unringed pores; green cells in cross section mostly trapezoidal, more broadly exposed on the inner surface. Monoicous. Spores more or less 25 µm, nearly smooth.

Illustrations. Crum (1984), Fig. 61; Daniels & Eddy (1985), Fig. 33.

A minerotrophic species growing at the drier edges of open bogs, poor fens and in loose mounds in swampy hardwood and coniferous forests. In Maine known from Androscoggin (*Allen 22489* DUKE, MO), Cumberland (*Lowe 74* DUKE), Hancock (*Rand 8/19/1892* DUKE, NY), Lincoln (*Allen 1340* MO), Oxford (*Holcombe 318* DUKE), Penobscot (*Fernald 7/8/1891* NEBC), Sagadahoc (*Allen 15778* DUKE, MO), Waldo (*Johnson 1885* DUKE), Washington (*Pedano 612* DUKE, MO), and York (*Pursell 12117* DUKE, MAINE, MO, NY, US) Counties.

Sphagnum fibriatum is unlikely to be confused with any other Maine species of *Sphagnum*, except *S. girgensohnii*. These two species have broadly rounded stem leaves that are lacerated across the apex. Those of *S. girgensohnii* are broadly lingulate and generally short-lacerate across a broadly truncate apex with the lacerations not extending very far down the sides of the stem leaves. The stem leaves of *S. fimbriatum* are broadly and shortly spatulate with widely rounded apices, and the lacerations extend around the entire upper sides of the stem leaves.

The stem leaves of *S. fimbriatum* at first glance strongly resemble those of *S. lindbergii* Schimp. *ex* Lindb, an arctic species that is disjunctive to the Gaspé in

Canada, and to three isolated, high mountains in New Hampshire and New York. It is not known from Maine, but conceivably could be found there at high elevations. *Sphagnum lindbergii* is a member of section *Cuspidata*, and as such can be separated from *S. fimbriatum* by examining its branch leaf green cells in cross section. In *S. lindbergii* the green cells have greater exposure on the outer surface of the branch leaves, while in *S. fimbriatum* they are more broadly exposed on the inner surface.

Acknowledgments. We thank the curators of BING, FH, NEBC-FH, NY, and NYS for the loan of specimens, and Patricia Ledlie for assisting in arranging the FH-NEBC loan. We are most appreciative to Molly McMullen for her help in handling the many specimens involved in the study, and most of all for proofreading the manuscript. Richard Andrus has been most helpful in many ways.

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A safe and accurate method to apply spot test chemicals to lichen thalli in the laboratory and the field.

F. Bungartz

Color reactions of spot test chemicals are still routinely used for lichen identification. The most common substances are: p-phenylendiamine (P) which reacts yellow to orange or reddish color with many depsides and depsidones; potassium hydroxide (K) which helps to differentiate anthraquinones and pulvinic acids; calcium hypochloride (C) which reacts with depsides and xanthones; and Lugol's Iodine (I) to detect starch-like substances. The application of these spot substances is potentially quite hazardous and some authors recommend substitutes (Dobson 2001a, Wirth 1995). P has been reported to cause cancer and serious allergic skin reactions (Dobson 2001b). It will stain and deteriorate paper and cloth. K is extremely caustic and even dilute solution will damage skin. Although commonly used as household bleach the aggressive bleaching potential of C should not be neglected. Even iodine can be hazardous to persons with thyroid diseases.

These facts are well known among lichenologists and emphasized in modern identification manuals (Brodo et. al. 2001, Nash et. al 2002, Wirth 1995, Purvis 1992) but people tend to get careless as a result of routine handling of spot test chemicals. Various methods have been described for the safe application of sot tests, using dropper bottles, fine pipette tips, dissecting needles or capillary tubes. All these methods require handling of rather large amounts of chemicals with little protection. The color reactions have to be observed under the dissecting microscope to study the color changes. In the process vials and dropper bottles can easily be tipped over. Mixing p-phenylendiamine crystals with ethanol freshly will result in the evaporation of ethanol, leaving a very fine dust which will easily disperse. Even micropipette droplets are often too big and difficult to apply to distinct thallus areas.

A much more convenient and safe method of spot testing can be achieved with refillable technical pens used by architects and artists for precise ink drawings. These "radiograph" pens (distributed e.g. under the brand name "KOH-I-NOOR") can easily be filled with reagents using safety precautions like protective clothing and gloves under a laboratory hood. Once filled with the reagent, spot tests can be very easily and precisely administered with almost no potential hazard. The plastic of the pens will only break under considerable force and if used according to the instructions these pens will not leak. The pens can be

Lichen Herbarium, Dept. Plant Biol. P.O.BOX 1601, Arizonia State Univ., Tempe AZ 85287-1601

purchased at a variety of tip sizes from 0.13 mm to 2.00 mm width. This allows very accurate application in the laboratory, e.g. testing the medulla of a specimen without spilling spot test solution on the cortex of a thallus. I use a 0.25 or 0.30 mm tip in the laboratory and a 1.20 mm tip for testing in the field.

Even after several month none of the chemicals have so far corroded any of my pens (not even the pen used for KOH shows signs of corrosion!). A potential hazard is clogging of the tip by drying chemicals or dirt and thallus material. It is necessary to place the cap onto the pen soon after use. Clogging dirt or thallus material can usually be removed carefully with lint-free tissue or by dipping the pen in distilled water. I have experienced that especially C frequently clogs the fine "laboratory" pen and the use of a slightly wider tip may help to prevent this problem. If chemicals have been allowed to dry over considerable time, bathing the tip in distilled water for prolonged times may help. The pens come with quite detailed cleaning instructions. Obviously any cleaning should be done with caution using protective clothing and discarding water baths. Tips which have been severely clogged and cannot be cleaned must be replaced. Tips are sold separately. I have now used pens for more than three month and did not have to replace any of them. Unfortunately radiograph pens and replacement tips are fairly expensive (ca. $ 14-25 per pen and ca. $ 8-12 per replacement tip).

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Guide to contributors to *EVANSIA*

The aim of *Evansia* is to provide a vehicle for the presentation and exchange of useful information on North American bryophytes and lichens. Articles are frequently popular in nature rather than technical and are intended to teach and inform both amateurs and professionals. The articles include, but are not restricted to, announcements of and reports on forays and meetings, presentations of techniques and aids for studying and curating lichens and bryophytes, and reports on local floras. Checklists and papers documenting new regional, state, or county records must include voucher specimens (collector and collection number) and an indication of where the specimens are deposited or a literature reference.

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Making Storage Boxes for Bryophyte Packets

Paul G. Davison[1]

For the regional herbarium, "homemade" boxes made from acid-free herbarium genus covers provide an inexpensive, readily available, standard method for storing bryophyte packets in herbarium cabinets. I began making and using these boxes a few years ago and find them well suited for organizing a growing bryophyte herbarium.

Small shoebox size boxes are common storage solutions for keeping bryophyte specimen packets organized (see Conard & Redfearn 1979, Ireland & Bellolio-Trucco 1987, and Schofield 1985). In fact, the very large bryophyte herbarium at the University of British Columbia is housed almost entirely in shoeboxes stored on open shelves. If cabinet or shelf space is not limiting, finding adequate storage boxes is relatively easy, but for the small herbarium short on space, an odd assortment of boxes and trays wastes precious shelf space. One way to standardize the storage of bryophytes is with herbarium bin boxes sold by herbarium supply houses, yet these require dividers to prevent interdigitation of two rows of packets, are not acid-free, and have slightly less available width in which to store packets than the boxes here proposed. Faced with very limited space and the immediate need for additional storage boxes at the University of North Alabama, I found a solution (thanks to a penchant for origami) simply by folding herbarium genus folders into open boxes of standard size.

Instructions for creating boxes from standard heavy Manila (caliper 0.015 in) 17 x 24 in unfolded genus covers follow. The numbers below refer to Figures 1-3.

1. With scissors or razor knife remove 1 5/8 in from the long side of 17 x 24 in genus cover. Save the trim as a template for trimming additional genus covers. Score with a hard metal edge (I use a door key) and fold/unfold along the indicated lines. Scoring controls the exact line of fold. Rub a smooth, hard object down the fold to make the creases sharp. To save measuring the scoring lines, create template strips from cardboard or genus covers to guide the scoring tool.

2. The only tricky fold is in forming the corners of the box. Push slightly inward at arrows and align edge “a” with edge “b.” Hold edges “a” and “b” firmly together and crease from the inside. The corner crease will find itself as you

---

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align, meet and hold edge “a” to “b.” Press firmly while creasing. Fold/unfold all four corners.

3. Once all folds have been made, shape the box and adhere each end with tape, glue or staples. I use a clear 2-inch wide commercial-grade box packing tape and cover the entire outer face of each end. The tape provides a tear resistance surface for taping and removing labels that identify the box contents. If handled carefully, as specimens should be, the boxes are adequately sturdy. Placing cardboard inside the upright ends strengthens the boxes but is not required.

The finished box is 17 1/4 in long, 6 3/8 in wide and 4 ½ in tall and occupies the full depth of standard herbarium cabinets. Boxes of similar dimensions were recommended by Flowers et al. (1945). Two boxes fit side by side on one shelf or bin. Each box holds roughly 40 to 130 upright specimen packets (depending on the volume of the actual specimens). Measurements of herbarium cabinet shelves do vary slightly between manufacturers, so the measurements given in the folding instructions may need slight adjustment. The measurements may also be adjusted to construct a box of smaller dimensions to fit various shelf space or to function as a lid.

Acknowledgments. I thank Todd Nickerson for assistance with the illustrations.

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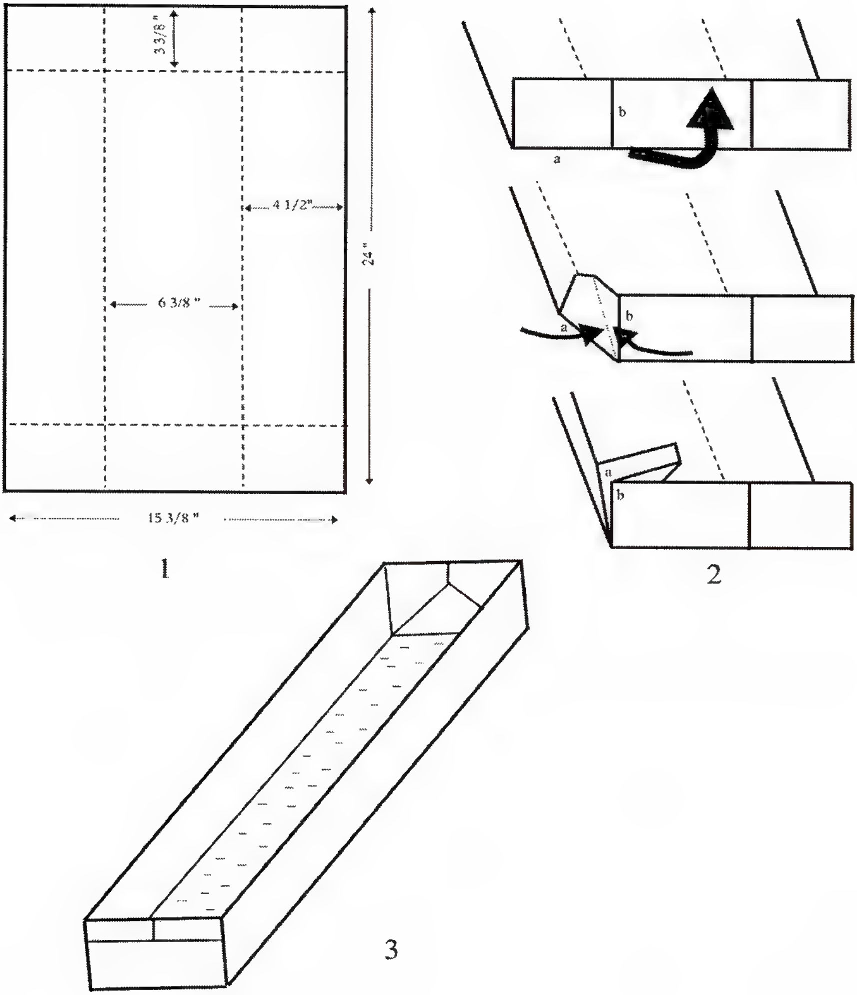

Figures 1-3. Conversion of herbarium genus cover into bryophyte packet storage box. See text for explanation.

Pilophorus clavatus and *Pseudocyphellaria crocata* new to the interior of western North America

Toby Spribille[1]

The occurrence of plants with oceanic affinities in inland regions has always fascinated plant geographers in northwestern North America. Already Kirkwood (1927) observed the reappearance of many plant species with coastal affinities in the northern Rocky Mountains. Daubenmire (1969), Johnson & Steele (1978) and especially Lorain (1988) greatly expanded our knowledge of this phenomenon among the vascular plants, while Schroeder & Schroeder (1972), McCune (1984) and Goward (1994) pointed to similar distributions of lichens with oceanic tendencies in the interior.

As part of an ongoing lichenological survey of inland wetbelt forests of northwestern North America, I was referred by Diane Penny of Priest River, Idaho, to a site in southeastern interior British Columbia, near the town of Nakusp. In May 2001, I had the opportunity to visit this site and document its flora. The representation of oceanic species was indeed impressive. Many of the species encountered are rarely found in inland regions, but here they were quite richly represented, particularily around two waterfalls which produced impressive spray zones. Most outstanding though were two species which were previously unknown from interior regions of western North America: the colourfully yellow-sorediate *Pseudocyphellaria crocata* (L.) Vainio and the fruticose saxicolous species *Pilophorus clavatus* Th. Fr..

Pseudocyphellaria crocata was found on branches of trees (mostly *Tsuga heterophylla*) and on vertical rock walls in the spray zone of a waterfall, and it was locally quite abundant. Among the many associated oceanic species were *Pseudocyphellaria anomala*, *Sticta fuliginosa* and *Sticta oroborealis*. Although the species is found around Lake Superior and inland in other portions of eastern North America (Brodo et al. 2001), this is the first definitive inland report of *P. crocata* from western North America.

Pilophorus clavatus appeared to be rare at the Nakusp site. The more common *Pilophorus acicularis* was abundant, occurring on exposed granitic rocks along the trail to Nakusp Hot Springs, but *P. clavatus* was found only in one place. Neither of these species were directly associated with the waterfalls.

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Subsequently, I found *Pilophorus clavatus* also at one other locality, about 160 km south of Nakusp in the upper Priest River area of extreme northwestern Idaho, only a few kilometres south of the Canadian border. The species was actually abundant here along a hiking trail, colonizing extensive areas of granite which had been exposed during trail construction. Interestingly, there was no sign of *P. acicularis*, which was the only *Pilophorus* species up until now reported from Idaho. The forest vegetation was a combination of *Tsuga heterophylla* and *Thuja plicata* in the overstory and luxuriant undergrowth of the fern *Polystichum munitum*, a forest structure at least physiognomically reminiscent of some coastal rainforests.

Pilophorus clavatus has been reported to occur rarely on the east slope of the Cascades by McCune & Geiser (1997), but even in British Columbia, where inland oceanic disjuncts are frequent, the species had not been found farther inland than the Kispiox River valley of west-central British Columbia. These collections, more than 400 km from the ocean, represent the first inland reports of the species, which otherwise closely hugs the North American Pacific coastline from Oregon to Alaska and that of eastern Asia from Chukotka to Japan and Taiwan (Jahns 1981).

Specimens:

Pilophorus clavatus. **CANADA. British Columbia.** NE of Nakusp, trail to Nakusp Hot Springs along Kuskanax River, ca. 50°18'N 117°37'W, 11 May 2001, *Spribille 10784* (UBC). **U.S.A. Idaho.** Boundary Co., trail to Upper Priest Falls, ca. 48°59'N 116°55'W, 20 Jul 2001, *Spribille 11175* (CANL, COLO, US).

Pseudocyphellaria crocata. **CANADA. British Columbia.** NE of Nakusp, Gardner Creek on road to Nakusp Hot Springs, ca. 50°18'N 117°42'W, 11 May 2001, *Spribille 10832, 10833* (CANL, UBC).

Acknowledgments. I thank Diane Penny for telling me about the Nakusp site.

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Bryophytes and Lichens of the Huron Mountain Club Conclusion

William R. Manierre[1]

In 1999, *Evansia* published "Bryophytes and Lichens of the Huron Mountain Club" which provides information on and complete lists of mosses, liverworts and lichens documented as growing within this approximately 20,000 acre holding in Marquette County of Michigan's Upper Peninsula. "Additions to the Lichen Flora of the Huron Mountain Club" followed in July 2001 and completed the lichen count to that date. The present report gives final numbers for the entire project and concludes what is intended as a single tripartite essay.

Mosses

Anomodon rugelii (C. Mull.) Keissl.
Brachythecium turgidum (Hartm.) Kindb.
Brachythecium velutinum (Hedw.) Schimp. *in* B.S.G. var. *velutinum*
Bryum alpinum Huds. *ex* With.
Bryum muehlenbeckii Bruch & Schimp. *in* B.S.G.; two forms, Crum & Anderson, p. 565
    a) acute-leaved, b) obtuse-leaved
Bryum pallens (Brid.) Sw. *in* Rohl.
Bryum pallescens Schleich. *ex* Schwaegr.
Bryum ruderale Crundw. & Nyh.
Bryum violaceum Crundw. & Nyh.
Campylium polygamum (Schimp. *in* B.S.G.) C. Jens.
Campylium radicale (P. Beauv.) Grout
Campylium stellatum (Hedw.) C. Jens. var. *stellatum*
Campylium stellatum var. *protensum* (Brid.) Bryhn
Distichium capillaceum (Hedw.) Bruch & Schimp. *in* B.S.G. var. *capillaceum*
Encalypta procera Bruch
Fissidens bryoides Hedw., "minutulus expression" Crum & Anderson, p. 105
Fontinalis neomexicana Sull. & Lesq.
Grimmia donniana Sm.
Grimmia pilifera P. Beauv.
Grimmia tenerrima Ren. & Card.
Grimmia teretinervis Limpr.
Grimmia trichophylla Grev.
Grimmia unicolor Hook. *in* Grev.
Hypnum curvifolium Hedw.
Leptodictyum humile (P. Beauv.) Ochyra
Leskea gracilescens Hedw.
Limprichtia cossonii (Shimp.) Anderson, Crum & Buck
Myurella sibirica (C. Mull.) Reim
Platydictya confervoides (Brid.) Crum

[1] Huron Mountain Wildlife Foundation, Big Bay, Michigan 49808

Polytrichum commune Hedw. var. *perigoniale* (Michx.) Hampe
Pylaisiella polyantha (Hedw.) Grout

Former total: 259 Added here: 31 Current total: 290 in 111 genera

Liverworts

Barbilophozia kunzeana (Hub.) Gams.
Cephalozia bicuspidata (L.) Dum. subsp. *bicuspidata*
Cephalozia macounii (Aust.) Aust.
Cephalozia pleniceps (Aust.) Lindb. var. *pleniceps*
Cephaloziella divaricata (Sm.) Schiffn. var. *divaricata*
Frullania brittoniae Evans
Frullania tamarisci (L.) Dum. subsp. *asagrayana* (Mont.) Hatt.
Jungermannia crenuliformis Aust.
Jungermannia exsertifolia Steph. subsp. *cordifolia* (Dum.) Vana var. *cordifolia*
Jungermannia leiantha Grolle
Jungermannia pumila With.
Lophozia incisa (Schrad.) Dum. var. *incisa*
Lophozia sudetica (Nees) Grolle
Scapania cuspiduligera (Nees) K. Mull. var. *cuspiduligera*
Scapania umbrosa (Schrad.) Dum.
Tritomaria exsectiformis (Breidl.) Loeske subsp. *exsectiformis*

Former total: 67 Added here: 16 Current Total: 83 in 36 genera

Lichens

Calicium parvum Tibell
Caloplaca flavorubescens (Hudson) J. R. Laundon
Caloplaca saxicola (Hoffm.) Nordin
Chaenotheca chrysocephala (Turner *ex* Ach.) Th. Fr.
Cyphelium tigillare (Ach.) Ach.
Fuscopannaria leucosticta (Tuck.) P. M. Jorg.
Lecanora argopholis (Ach.) Ach.
Pertusaria hymenea (Ach.) Schaerer
Rhizocarpon disporum (Nageli *ex* Hepp) Mull. Arg.
Rhizocarpon geminatum Korber
Rhizocarpon, a second unnamed species described in Wetmore, *Minnesota*, p. 69, second taxon of dichotomy 13
Rhizoplaca subdiscrepans (Nyl.) R. Sant. (Weber & Wittmann 1992)

Former total: 280 Added in Part II: 35 Added here: 12
Current total 327 in 91 genera

Current total lichens: 327
Current total bryophytes: 373
Total non-vascular: 700 in 238 genera

A recent *Bryologist* article (Spring 2002) estimates the total number of vascular plant species at Yellowstone Park at 1265 and of lichen species at 359 with "a ratio of 3.5 vascular plant species to lichen species" (Eversman et al, 2002). It is astonishing that this small reserve on Lake Superior should harbor 91% of the lichen species ascribed to that great National Park. It is also interesting that our ratio of 2.1 (based on 810 species of vascular plants) differs recognizably from Yellowstone's 3.5 and much more noticeably from the "6 to 1" given for the United States as a whole. Other relationships are attainable from the following: lichen species common to both Huron Mountain and to Yellowstone Park 130; at Huron Mountain but not reported from Yellowstone 197; reported from Yellowstone but not from Huron Mountain 229.

One hundred miles northwest of Huron Mountain, Isle Royale National Park offers pertinent contrasts. In his "Final Report" on "Lichens and Air Quality" at that location, Clifford Wetmore (1985) lists 486 species of which the total number from Huron Mountain represents 67%, considerably less than 91%, but still respectable. Common to both places are 247 species, 80 are reported from Huron Mountain, but are absent from Isle Royale and 179 at Isle Royale, but not here. Such figures were not previously available and are large enough to deserve consideration.

Initially, I justify comparison of this microcosm with enormous Yellowstone on the basis of near identity of species numbers, a fact which is certainly surprising and not, I surmise, formerly suspected. The second comparison of "great things with small" is warranted by the much lesser size of Isle Royale (about 7 times larger than Huron Mountain while Yellowstone is more than 100 times larger), its greater proximity to the Club and the political fact of both being in Michigan, not to mention that one is actually in Lake Superior, the other bordering on that lake.

Tree species at Isle Royale are nearly all the same as those providing substrate for lichens at Huron Mountain, those at Yellowstone almost entirely different. In spite of this, and in matters unrelated to magnitude, our microcosm on Lake Superior differs as much from Isle Royale as it does from Yellowstone.

The mere fact of insularity of the main island as of its numerous neighboring islets surely contributes to diversity of species. Nor is there any parallel at Huron Mountain to Isle Royale's dominating ridge and valley topography. Isle Royale's rocks stem largely from the later Precambrian, Huron Mountain's go back to the early Precambrian Era and are more than a billion years older. They display primarily Archean amphibolites and granitic gneisses and are metamorphosed and deformed.

More evident at the surface is that “most of the rocks on Isle Royale are basaltic and conglomerate”(ibid.). In contrast, Huron Mountain has basalt only in a few dikes cutting through the bedrock whereas flood basalts constitute the bedrock of Isle Royale. Conglomerate seems absent at Huron Mountain. In contrasting two lichen sites these differences in primary substrates would seem a defining factor.

East along the Lake Superior coastline, and but 75 miles by crow from Huron Mountain, Pictured Rocks National Lakeshore is a major and well-known natural feature of Michigan’s Upper Peninsula. Clifford Wetmore’s (1988) “list of 235 taxa” presents the first published listing of its lichen species.

Differences between topography and subsurface at Pictured Rocks and at Huron Mountain deserve mention. At Huron Mountain old-growth hemlock-hardwood forest predominates; at Pictured Rocks “the whole area was extensively logged earlier in the century and most of the vegetation is second growth” (ibid.). Except for beech, which Huron Mountain lacks, tree species are the same. While Huron Mountain looks like a mountain with rough and mountainous terrain, Pictured Rocks towers some 400 ft. over lake surface but does not resemble a mountain. “The eastern part has sand bluffs along the lake and the western part has sandstone rock cliffs” (ibid.). It really is all sandstone lacking Huron Mountain’s metamorphosed igneous rocks, its Archean gneisses and amphibolites. Both locations share considerable sandstone substrate, Huron Mountain along the Lake Superior shoreline and sporadically inland. But Huron Mountain’s is Jacobsville sandstone, older than and differing from those of the Munising formation.

In any event, figures for lichen taxa in both areas are 327 at Huron Mountain and 235 at Pictured Rocks. The Park has, then, some 72% of our species, a figure that must be qualified by Clifford Wetmore having limited his collecting to a number of selected sites. He does not pretend to have examined the entire area. Nor do I, for that matter, claim to have done anything else for my much smaller location.

Requiring no qualification is the number of species common to both sites 146. This strikes me as uncommonly high, representing 62% of Wetmore’s total and 46% of mine. One might well expect a smaller proportion of species held in common in view of the limited amount of similar habitat.

Bryophytes have received the emphasis in four of five previous reports on this project. In concluding it, I now return to the bryophytes by comparing moss and liverwort species totals with those reported from the Keweenaw Peninsula situated on Lake Superior roughly midway between the Hurons and Isle Royale.

Two fundamental features define the peninsula's geologic characteristics. The first is that "Isle Royale and the Keweenaw Peninsula [are] geologic counterparts on opposite sides of a structural basin occupied by Lake Superior" (Huber 1983). The northern half of the Keweenaw represents the southern margin of that synclinal basin and shares the rocks of Isle Royale, largely basalts and conglomerates. The second defining feature is the Keweenaw Fault which by cutting the peninsula from western base to eastern tip divides it nicely into northern and southern halves each consisting of different rocks and substrates.

The southern half consists almost entirely of Jacobsville sandstone and the sands eroded from it. This material is shared by Huron Mountain's shoreline and limited surface areas more inland. But, as we have seen, the basalts and conglomerates of the northern half are not shared by Huron Mountain whose Archean granite gneisses and amphibolites are among the oldest rocks on earth and absent from Houghton and Keweenaw Counties.

The Keweenaw Peninsula is an extraordinarily rich repository of bryophytes. It has hosted bryological forays and been scoured by such eminent bryologists as W.C. Steere and F.J. Hermann since 1933 when George Nichols began the serious collecting of bryophytes in the Upper Peninsula. Its production of moss rarities is unsurpassed in the state, all this in spite of a century of unrestricted copper mining and unsustainable forestry.

Janice Glime's (1985) "Checklist of Bryophytes and their Critical Localities in the Keweenaw Peninsula" is particularly relevant. This article lists all of the bryophytes she and her assistants were able to find in the field, the literature and the major Michigan herbaria. Bryophyte species totals for Huron Mountain and for the Keweenaw are similar. Keweenaw's 252 moss species represent 87% of Huron Mountain's 290 while the latter's 83 liverwort species are 95% of Keweenaw's 90 with 57 dissimilar: 25 for Huron Mountain and 32 for the Keweenaw.

It is noteworthy that 62 mosses are reported from the Keweenaw but not from Huron Mountain and rather astonishing that the much smaller site has 100 species apparently lacking in Houghton and Keweenaw Counties. It is more striking still that, considering enormous differences in magnitude, habitat and ecological condition these two locations should have so many species in common, 190 mosses and 52 liverworts. It is for the experts, however, to weigh the implications of these facts.

The causes of the numerical similarities and differences cited here are so many as to be beyond certain identification. Surely not all of them are random. Some must relate to size of location, but no site is ever fully investigated and a host of experienced investigators gathering thousands of specimens can scarcely be expected not to gather more species per square meter than a lone, elderly amateur who declines to over-collect.

One thing does seem indisputable. Within the boundaries of the Huron Mountain Club exists an area of considerable bryological and lichenological diversity. Presumably a degree of protection has played a part in keeping it that way for over a century, but that has not really been demonstrated. Non-vascular species can exist in tiny niches protected by natural features from many of the most destructive, modern innovations. But lichens and bryophytes do exceedingly poorly with impure moisture or polluted air. In spite of promises to the contrary, no earthly site can ever be protected forever. The system just doesn't work that way.

Acknowledgements: I should like to express full gratitude to Aldo Leopold and Professor "Herb" Wagner. Their words and actions saved the Huron Mountain Club from what Dr. Wagner, shortly before his death in 2000, accurately termed "political and governmental manipulation" in the 1960's and thereby enabled it to continue until the present as a protected entity.

This project cannot be left without heartfelt recognition paid to Howard Crum (1922-2002). For fourteen years the two of us would meet weekly in his office for 2 ½ hours throughout six winter months pouring over taxa collected at Huron Mountain that had proved too difficult for me. I estimate that Howard gave to me and the project between six and seven hundred hours of his time in this fashion. That was the method established at our first meeting and pursued until 2002. It was, I imagine, a method unique in the annals of bryological investigation.

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Three additions to the lichen flora of North America from Mt. Katahdin, Maine

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Abstract. Carbonea intrusa, Cecidonia xenophana *and* Rhizocarpon amphibium *are reported for the first time from North America.*

Mt. Katahdin (45°54'N, 68°55'W) is the highest mountain in Maine at 1605 m and has the largest extent of alpine tundra in the state, approximately 10 km long by trail, including the upper parts of several glacial cirques. The entire mountain is protected by its location in Baxter State Park, which is neither government-owned nor supported by tax revenues. Baxter State Park has a unique mandate regarding natural resource preservation, and strictly controls collecting within the Park boundaries. In order to collect in the Park it is necessary to follow a special application process that includes going before the Director's Research Committee and receiving a permit to collect. Without following this process, any collecting in Baxter State Park is illegal and could result in prosecution.

Lichen exploration of the alpine slopes of Mt. Katahdin has been mostly casual, starting with Joseph Blake in 1856 (Harvey 1894) and continuing with R. H. Howe, Jr. in 1911 (Howe 1913). Even the more systematic collecting by Gunnar Degelius in 1939 (Degelius 1940) was apparently restricted to the immediate vicinity of the trails, with little or no exploration of glacial cirques or areas away from the trails. From 1939 to 2000, there was no serious collecting on Mt. Katahdin. In 2001 the senior and third authors, along with Norton G. Miller of the New York State Museum, Albany, NY, were allowed to collect on a one-time basis during the period August 24-26th. Sites visited included an east-facing ridge (Hamlin Ridge), the headwall of a steep, north-facing glacial cirque (South Basin), and a northwest facing slope of alpine tundra (the Tableland, northwest of Baxter Peak). Some of the specimens collected during this period of field work were sent to the second author for identification/confirmation.

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The current report is restricted to information on the three species collected on Mt. Katahdin in 2001 that are not included on the North American checklist (Esslinger 2001); detailed results of the 2001 field work will be published elsewhere and will include many new state and regional records. That three new North American records could be found in only three days of field work suggests that the alpine lichen flora of Mt. Katahdin is relatively poorly known, and that additional field work would be productive, such as that carried out in alpine areas of Washington State (Glew 1997, 1998) and in parts of Europe, for example, the Scottish Highlands (Fryday 2001a, b).

Carbonea intrusa (Th. Fr.) Rambold & Triebel
(syn. *Micarea intrusa* (Th. Fr.) Coppins & Kilias)

U.S.A., Maine, Piscataquis Co., Baxter State Park, Mt. Katahdin Township (T3 R9 WELS), South Basin, 1190 m, on a large slab of near-vertical granite between Chimney Gully and Waterfall Gully; associated lichens included *Rhizocarpon geographicum* (L.) DC. and *Tremolecia atrata* (Ach.) Hertel; 25 August 2001, *Hinds 4628* (MAINE).

Carbonea intrusa is an easily overlooked species because it often occurs as small isolated thalli growing between (or on) other lichens. It is characterized by simple to 1-septate ascospores, large, thick-walled algae with fungal haustoria penetrating the cells, and a pale orange, K+ purple-red pigment in the ascogenous hyphae, asci and ascospores. It also has a thin, reflexed, pale-brown exciple (Coppins 1983, 1992).

The Mt. Katahdin collection is small with only two apothecia, due largely to the difficulty of making a good collection from a large, flat slab of granite! The ascospores are mostly simple, but all other characters agree well with published descriptions of *C. intrusa*. Inspection of an exsiccata specimen of *C. intrusa* in MSC (Norrlin & Nylander, *Herb. Lich. Fenn.* 182 [as *Lecidea pelidna* Ach.]) revealed that this too had predominately simple ascospores.

Because of its relatively thick thallus and small dark, immarginate apothecia, *Carbonea intrusa* has a close resemblance to the common *Scoliciosporum umbrinum* (Ach.) Arnold, but that species has vermiform or sigmoid-curved, 3- to 7-septate ascospores. Microscopically, it is most likely to be confused with species of *Micarea*, although its well-developed thallus, generally exposed habitat, and relatively large ascospores separate it from most species of that genus.

Carbonea intrusa appears to be a widely distributed but rare species. In Europe it has been recorded from the British Isles, Scandinavia, France, Germany (Coppins 1983), Poland, and Iceland, and in Asia from New Guinea (Aptroot *et al.* 1997). However, it is probably more frequent than records indicate because it is overlooked for *Scoliciosporum umbrinum.*

Cecidonia xenophana (Körber) Triebel & Rambold

U.S.A., Maine, Piscataquis Co., Baxter State Park, Mt. Katahdin Township (T3 R9 WELS), 1450 m., lichenicolous on *Porpidia contraponenda* (Arnold) Knoph & Hertel (considered by the authors to include *Porpidia diversa* (Lowe) Gowan), which was on a granite boulder on the Tableland northwest of Baxter Peak; 26 August 2001, *Dibble 10354* (MAINE).

Cecidonia is a genus of two lichenicolous species growing on the thallus of *Porpidia* or *Lecidea* species. Both species have the appearance of being lichenized, but it is probable that the independent 'thallus' of *Cecidonia* is a gall-like modification of the host thallus.

Cecidonia xenophana grows on species of *Porpidia*, most often, as here, on *P. contraponenda.* It is an easily overlooked species as its white 'thallus' and black apothecia blend in well with that of its host species, although the thallus is usually more chalky white and the apothecia smaller (0.2-0.3mm diam.) than those of the *Porpidia.* Closer examination reveals the distinctive morphology of the *Cecidonia* apothecia, which are contorted with a thick prominent margin. The collection from Mt. Katahdin has ascospore dimensions of 11-13(-15) x (5-) 6-6.5µm. These dimensions, especially ascospore length, are towards the upper end of those published for European material, (9-)10-12(-13) x 5-6.5(-7.5)µm (Triebel & Rambold 1988). However all other characters, including ascospore width, height of hymenium, apothecia diameter, and host species agree well with *C. xenophana.*

Cecidonia has *Lecidea*-type asci, differing from *Lecidea* s. str. in having richly branched and anastomosing paraphyses and a carbonaceous exciple. It is further characterized by having small apothecia (<0.6 mm diam.) with a well-developed margin, and a relatively high hymenium (80-110µm). *Cecidonia umbonella* (Nyl.) Triebel & Rambold, the only other member of the genus, grows on species of *Lecidea,* has larger, umbonate apothecia (to 0.6 mm diam.) and larger ascospores (11-15(-16) x (6-)6.5-8(-10) µm). Its 'thallus' also contains norstictic acid (K+ red crystals) and has an I+ violet medulla, although this is probably derived from the host lichen, which is most often *Lecidea lapicida* var. *pantherina* (Ach.) Ach. (syn. *L. lactea* Flörke *ex* Schaerer).

Cecidonia umbonella and *C. xenophana* are both known from both north and central Europe. In addition, *Cecidonia umbonella* is known from Iceland, eastern Greenland, Japan (Inoue 1997), and in North America from a single collection from Colorado (Triebel & Rambold 1988).

Rhizocarpon amphibium (Fr.) Th. Fr.

U.S.A., Maine, Piscataquis Co., Baxter State Park, Mt. Katahdin Township (T3 R9 WELS), 1190 m., on granitic rock at bottom of Chimney Gully with intermittent running water; associated lichens included *Ionaspis lacustris* (With.) Lutzoni, *Porpidia thomsonii* Gowan, and *Verrucaria* sp.; 25 August 2001, *Hinds 4632* (MAINE).

Rhizocarpon amphibium is characterized by having a lead-gray thallus lacking lichen substances, ±innate apothecia 0.6-0.8 mm diam., hyaline, submuriform ascospores (5-10 cells visible in optical section), 23-27 x 10.5-12µm, and a K+ purple epihymenium (Fryday 2000). It is further distinctive in occurring in the inundation zone of upland streams and lakes; the only other species of *Rhizocarpon* with muriform ascospores that occupies this habitat being *R. lavatum* (Fr.) Hazsl., which has much larger apothecia and ascospores.

In Europe, *Rhizocarpon amphibium* appears to be a northern species, as it is widespread in Scandinavia (Santesson 1993) and is also known from the British Isles (Fryday 2000), but is apparently absent from the Alps (Feuerer 1978).

Acknowledgments. The authors would like to thank Elisabeth Lay for first recognizing that the *Rhizocarpon* might be *R. amphibium* and a new North American record, and the Baxter State Park Authority and Director Buzz Caverly for logistical support.

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New England Mosses: *Grimmia muehlenbeckii* Schimp. in Massachusetts and New Hampshire

Mary S. G. Lincoln [1]

On a recent visit to Massachusetts, Bruce Allen collected *Grimmia muehlenbeckii* Schimp. (*Allen 23895A* MO) on a rock wall in the town of Lincoln in Middlesex County, west of Boston. I have subsequently found the species in several other locations in the same town. One of these (*Lincoln 466*) has been deposited in the Farlow Herbarium. This moss has previously been reported from Maine (Allen 1993, as *G. hermannii* Crum), and I had also unwittingly collected it in New Hampshire, prior to being enlightened by Dr. Allen. (*Lincoln 87*, Merrimack County, Town of Hill. 10/7/00, FH). At least two misidentified specimens in FH from Worcester County, Massachusetts (*Davis 306*, Town of Barre, 9/22/1956 & *Davis 454*, Town of Southbridge, 10/25/1956), have turned out to be this species, as well. I would expect to find additional specimens lurking in herbaria, posing as *Schistidium apocarpum* or as other *Grimmia* species.

Grimmia muehlenbeckii was originally described by Schimper (1860) from Austrian material collected in 1840 by Mühlenbeck. Smith (1992) defined it as having denticulate to spinulose hyaline leaf apices, basal cells to three times as long as wide and a relatively small sporophyte with smooth capsule. The species has been treated as a subspecies (Dixon 1896) or variety (Husnot 1887) of the extremely variable *G. trichophylla* Grev. in part because its hyaline points are variably denticulate and stunted forms of *G. trichophylla* have smaller, less striate capsules that approach those of *G. muehlenbeckii.* Deguchi (1978), however, recognized this taxon at the species level on the basis of the presence of two low lamellae or projecting angles on the abaxial (dorsal) side of the costa in the upper half of the leaf. Smith (1992) also found that this feature distinguished *G. muehlenbeckii* from *G. trichophylla* and its varieties. Greven (1995) agreed that the taxon should treated as a distinct species, but since the costa in *G. muehlenbeckii* was only occasionally winged, he considered sporophytic characters to be more important in recognizing the species. Unfortunately *G. muehlenbeckii* is dioicous (as is *G. trichophylla*) and sporophytes are not only uncommon, but unknown in North America.

Grimmia muehlenbeckii was first reported from eastern North America (Upper Peninsula, Michigan) as *Grimmia hermannii* Crum. Crum (1974) in originally comparing his new species to *Grimmia muehlenbeckii* (as *G. trichophylla* var *tenuis*) considered it distinct on the basis of its smaller size, lack of strongly spinulose hair points, and the less nodulose and less elongate inner basal cells.

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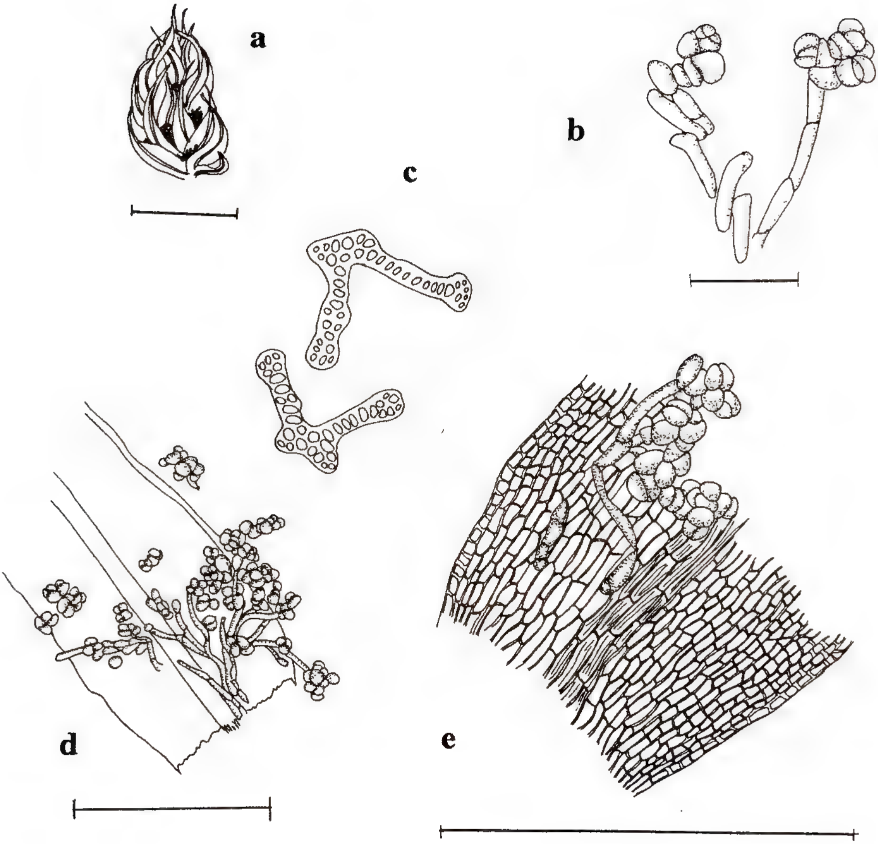

Figure 1. *Grimmia muehlenbeckii* **a**. habit (scale bar=1mm) **b.** gemmae on stalks (scale bar=.1mm) **c.** cross section of leaf showing winged costa **d.** leaf with gemmae (scale bar=.5mm) **e.** basal leaf cells with gemmae (scale bar=.5mm) Note lax cells from which gemmae arise. Figures a, b, d, e from *Lincoln 521*; figure c from *Allen 23895A*.

Munoz (2000) reduced *G. hermannii* to synonomy with *G. muehlenbeckii*. He considered the taxa similar in having keeled leaves with recurved margins, bluntly angled costae, and stalked, axillary propagulae. In addition, he found that in plant size, leaf hair-point length, and basal leaf cell shape *G. hermannii* fell within the range of variation exhibited by european populations of *Grimmia muehlenbeckii*.

The most unusual character of *G. muehlenbeckii* is the presence of the stalked gemmae clustered in the leaf axils. These could be mistaken for insect eggs at first blush. Crum (1974) reported that the rounded, green brood bodies produced in chains on filamentous stalks in the leaf axils are generally inconspicuous, though they sometimes occur in dense and obvious clusters too. Allen (1993) described the gemmae as globose, multicellular, green to greenish-red, and produced on short stalks from basal leaf cells. Greven (1995) attributed a brown color to the gemmae. In my collections they tend to be brownish-red or green with a reddish coloration in the cell walls. Allen (1993) states that the gemmae arise from basal leaf cells on both sides of otherwise normal vegetative leaves, and this is confirmed in my Massachusetts collections. Deguchi (1978) described the gemmae as arising only on the dorsal side of the leaves, and from both costal and laminal cells.

Grimmia muehlenbeckii can be difficult to recognize, though Allen (private communication) believes it to be fairly common in New England. It is the smallest species of *Grimmia* found in New England, with leaves only 1-1.5 mm in length. It could be mistaken for *Grimmia donniana* Sm. , which is also small but has plane leaf margins whereas the lower leaf margins are recurved on one or sometimes both sides in *G. muehlenbeckii*. The basal leaf cells of *G. muehlenbeckii* are quadrate, with straight walls, and the cross-walls of the basal marginal cells are sometimes thickened, while the basal cells of *G. donniana* are long-rectangular throughout. *Grimmia donniana* is also autoicous and frequently has sporophytes, while no sporophytes have yet been found on North American material of *G. muehlenbeckii*.

Grimmia muehlenbeckii could also be confused with the common and highly variable *Schistidium apocarpum*. The microscopic features which distinguish the two are both subtle and variable. Several characteristics will distinguish them in the field: *S. apocarpum*, being autoicous, usually has sporophytes, and tends to prefer a calcareous substrate (in this part of the country that often means mortar or cement), while *G. muehlenbeckii* is found on acidic rock. *S. apocarpum* also has leaves tightly appressed when dry, and frequently has a slight reddish coloration, whereas *G. muehlenbeckii* has a softer, greener aspect, with slightly spirally contorted leaves. Ultimately only the distinctive gemmae will lead to a definitive determination: fortunately these are nearly always present, though sometimes difficult to find.

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Campylium protensum (Musci: Amblystegiaceae) New to Missouri and Interior Highlands of North America

Carl Darigo[1]

Campylium is a genus of pleurocarpous mosses predominately found on soil, humus, logs or rocks, generally in moist, forest habitats. Five *Campylium* species, *C. chrysophyllum* (Brid.) J. Lange, *C. hispidulum* (Brid.) Mitt., *C. polygamum* (Schimp. *in* B.S.G.) C. Jens., *C. radicale* (P. Beauv.) Grout, and *C. stellatum* (Hedw.) C. Jens. var. *stellatum* have previously been recorded (Redfearn 1983 & 2001, Darigo 2000) in the Interior Highlands of North America, i.e., Missouri below the Missouri River, parts of eastern Oklahoma, northern Arkansas, and southern Illinois. This paper adds another species, *Campylium protensum* (Brid.) Kindb., to Missouri and the Interior Highlands of North America.

Campylium protensum was collected 23 March 2002 by Alan Brant while doing a herbaceous plant survey for the Mark Twain National Forest in a remote section of northwest Iron County, Missouri. This locality occurs in the St. Francois Mountains of the Interior Highlands. The collection (Brant 4975 MO) was made in Wolf Pen Hollow, five miles east of Bixby, elevation 1,100 ft. The moss, which had gametangia but no sporophytes, grew in scattered patches on soil in a seep near a stream in an upland oak-hickory forest. Associated with this species were *Bryum pseudotriquetrum* (Hedw.) Gaertn. et al. and *Fontinalis sphagnifolia* (C. Müll.) Wijk & Marg.

Crum & Anderson (1981) reported the distribution of *Campylium protensum*, as *C. stellatum* (Hedw.) C. Jens. var. *protensum* (Brid.) Bryhn *ex* Grout, in North America as British Columbia, Ontario, Quebec, Alaska, Michigan and New York.

Campylium protensum (Brid.) Kindb., Canad. Rec. Sci. 6 (2): 72. 1894.
Plants slender, in green tufts or mats, stems creeping, branching irregularly pinnately, leaves distant, spreading, entire, rounded to base, cordate, abruptly acuminate with acumen 55-75% of leaf length, acumen channeled, stem leaves 1.5-1.6 mm long x 0.5-0.6 mm wide, not decurrent, margins plane, costa missing or very short and double, cells smooth, linear, prosenchymatous with thin walls, median and upper cells 8-12:1, 5-6 µm wide, alar cells slightly enlarged, quadrate to oblong in small, differentiated clusters.

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This collection of *C. protensum* closely matches Hedenäs' (1997) description of the species, especially in leaf dimensions and acumen length. The following key is adapted from Hedenäs (1997).

Key to Species of *Campylium* in the Interior Highlands of North America

1. Costa missing or very short and double 2
    2. Slender plants; leaves spreading to squarrose, serrulate; stem leaves less than 0.9 mm long; alar cells small, firm-walled .... *C. hispidulum*
    2. Robust plants; leaves spreading, entire; stem leaves more than 1.0 mm long; alar cells slightly enlarged to enlarged, thin-walled 3
        3. Alar cells enlarged; stem leaves 1.7-2.8 mm long x 0.7-1.2 mm wide, acumen 40-65% of leaf length .... *C. stellatum* var. *stellatum*
        3. Alar cells slightly enlarged; stem leaves 1.0-2.3 mm long x 0.4-1.0 mm wide, acumen 55-75% of leaf length .... *C. protensum*
1. Costa single, ending near or slightly above the middle of leaf 4
    4. Stem leaves long-decurrent, erect to spreading when wet, distantly spaced .... *C. radicale*
    4. Stem leaves not to slightly decurrent, spreading to squarrose when wet, crowded on stem 5
        5. Leaves spreading, lanceolate to ovate-lanceolate, gradually acuminate; alar cells inflated .... *C. polygamum*
        5. Leaves wide-spreading to squarrose, ovate-lanceolate, abruptly acuminate; alar cells small to slightly enlarged .... *C. chrysophyllum*

Acknowledgments. I thank Alan Brant for permission to publish his collection, also Bruce Allen and Lars Hedenäs for confirming identity of the specimen.

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Leskea polycarpa Hedw., new to the moss flora of Alaska.

R. D. Seppelt[1] & Gary A. Laursen[2]

Abstract: *Leskea polycarpa* Hedw., is reported from near Kavet Creek, north of the Great Kobuk Dunes, Kobuk River Valley, in Arctic Alaska. The species is described and illustrated, and its morphology discussed.

Short summer seasons in high northern latitudes, remoteness and huge scale, and logistic difficulties limit access to much of the Arcto-Boreal and true tundra regions. Over several field seasons we have been based at a remote riparian camp site near Kavet Creek, a small entrant stream on the southern banks of the Kobuk River at 67°07.724'N, 159°02.163'W, carrying out biodiversity and ecological studies of fungi and their vascular plant and bryophyte associations. The locality is at the northern end of the Greater Kobuk Sand Dunes, within the Kobuk National Park and Wilderness.

The Greater Kobuk Sand Dunes in the central Kobuk River Valley of north western Alaska are a 62 sq. km remnant area of a once much larger (650 sq. km) sand deposit formed probably during the Late Pleistocene Wisconsin and earlier glaciations. Glacial erosion of quartzose rocks of the Brooks Range followed by transport and deposition by glaciolacustrine, alluvial and eolian processes contributed to the origin of the present day sand deposits (Pewe 1975; Dijkmans and Koster 1990; Hamilton and Ashley 1993). A combination of open, lichen woodland, white spruce (*Picea mariana*) forest, and riparian tall shrub now covers much of the former extensive sand sheet. Several active dune systems - the Greater Kobuk, Little Kobuk (8 sq. km), and a smaller 2 sq. km system near the mouth of the Hunt River - now represent visible remnant islands within the greater Boreal ecosystem (Parker & Mann, unpublished).

Mean annual precipitation in the central Kobuk Valley is of the order of 300-500mm, based on data obtained from weather stations along the southern slopes of the Brooks Range. Further inland the climate is significantly drier. Mean annual temperature is around -6°C and mean July (mid-summer) temperature is 15°C. The Kobuk Valley is windier than many other parts of interior Alaska with mean yearly wind speeds of 6.0-6.4 $m.s^{-1}$ being recorded from the central and lower Kobuk Valley (DeHarpporte 1983).

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The Kavet Creek area, where we have been based, drains along the north western edge of the Greater Kobuk Sand Dunes. Above the limits of spring thaw ice erosion and summer floods the sand flats and river banks are fringed with *Equisetum fluviatile* associated with a variety of forbs and grasses. Behind this occur dense *Salix alaxensis*-dominated thickets with scattered *Populus trichocarpa* and *Alnus crispa,* which are then supplanted by a complex shrub-heath-Boreal forest community, dominated by *Picea mariana*, with scattered fens and wet depressions.

Fruiting specimens of *Leskea polycarpa* were found at a number of locations, predominantly in the *Salix* thickets. The sites are subject to periodic ephemeral flooding following heavier rain falls but do not appear to be inundated by flooding from either the Kobuk River or Kavet Creek. It is possible that early Spring thaw overflow from Kavet Creek, when the release and flow of flood waters in and into the Kobuk River is inhibited by ice, may contribute to seasonal inundation.

Considering the size, the remoteness and difficulty of access of much of the State, it is to be expected that not only new records but, potentially, new species will be found in Alaska. As a result of previous field work in the Greater Kobuk Dunes area, we reported as new, both to Alaska and the Arctic, the occurrence of the hepatic *Riccia cavernosa* Hoffm. emend Raddi from several locations along the Kobuk River shore (Seppelt & Laursen 1999). Amongst the collections we have made are other significant new Alaskan records which will be the subject of subsequent reports.

Description of *Leskea polycarpa*:

Plants have been found on silt and litter and at the base of Salix saplings, forming loose procumbent mats; stems subpinnately branched, both stems and branches densely foliate (Fig. 1). The tips of the stem and branches are often slightly curved. Stem leaves (Figs. 5, 6) are ovate-lanceolate, subsecund, 1-1.3mm in length, 0.4-0.45mm wide, tapering to an acute apex; the costa ceases shortly below the apex of stem leaves. Branch leaves are ovate-oblong to ovate-lanceolate, up to 0.9mm in length, 0.3-0.45mm in width, of similar shape (Figs. 2, 3) to stem leaves or, in shorter and more ovate-oblong leaves (Fig. 4), the leaf apex is more obtuse. In these shorter leaves the costa reaches barely to mid-leaf and may be weakly forked toward the tip. Perichaetial leaves (Fig. 7) are up to 1.5mm in length, oblong-lanceolate, long-sheathing, with the costa extending almost to the apex.

Paraphylia (Figs. 8-10) are present but are, in the specimens examined, very few in number, inconspicuous and very easily overlooked. The cells are smooth, but occasionally a few cells may bear a single papilla (Fig. 10). Lack of observation of the paraphylia leads immediately to misidentification of the moss.

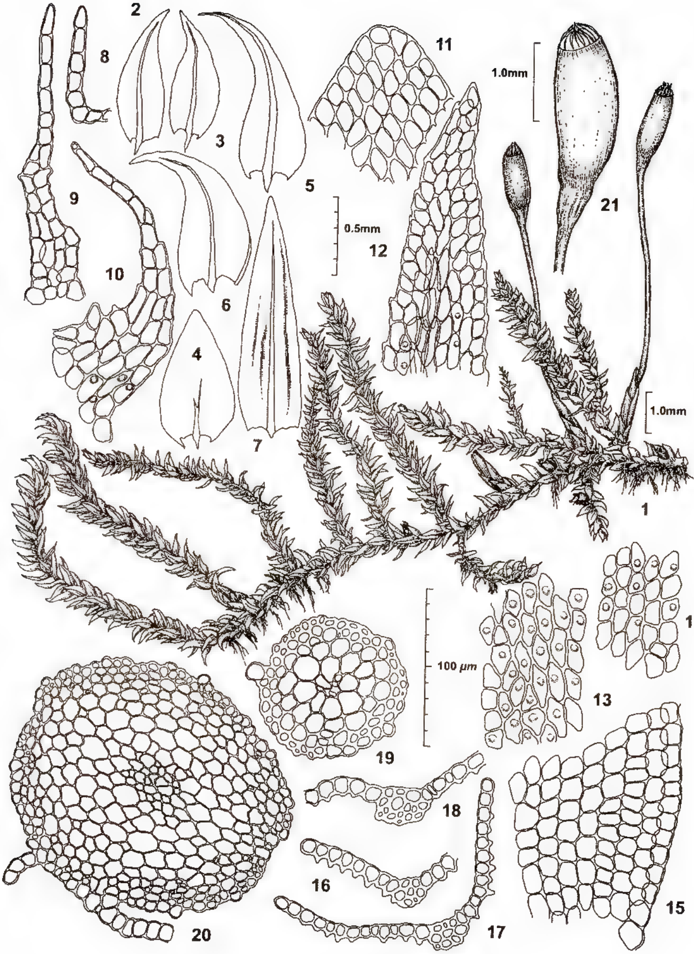

Fig. 1 - Habit of plant. 2-4 - Branch leaves. 5,6 - Stem leaves. 7 - Inner perichaetial leaf. 8-10 - Paraphyllia. 11,12 - Leaf apices. 13,14 - Cells from mid to upper lamina showing single abaxial papilla. 15 - Basal cells of leaf. 16-18 - Leaf and costal sections. 19 - Section of branch. 20 - Section of stem. 21 - Capsule, drawn wet. Scales: = 1.0mm for habit and wet capsule; 0.5mm for leaves; 100μm for cells and sections.

Leaf margins are smooth to weakly denticulate near the apex by projecting cell ends (Fig. 12), and plain or revolute to near the middle.

Leaf cells are papillose with a single abaxial papilla (Figs. 13, 14), but are smooth near the apex and base (Fig. 15). Occasionally, adaxial papillae occur around the middle of the leaf. Cell shape (Figs. 11-14) varies from rounded to rhomboid or ovate-hexagonal, becoming longer towards the base. There is a group of more or less quadrate alar cells (Fig. 15).

The costa ends below the apex in all leaves. It is weakly prominent on the abaxial surface and lacks stereids or deuter cells (Figs. 16-18).

In section, stems (Fig. 20) and branches (Fig. 19) have a small central strand of smaller and thinner-walled cells than the surrounding medullary cells. The outer few rows of cells are slightly smaller and thicker-walled.

Gynoecia and capsules (Figs. 1, 21), as the epithet indicates, are numerous along the stems. In the Alaskan specimens examined the capsules are 1.5-1.6mm in length, cylindric to weakly arcuate, erect to slightly inclined, and borne at the end of a reddish seta 5-6mm in length. The double peristome is a pale whitish-brown.

The spores are greenish, papillose-verrucose and, in the specimens examined, range from 12.5-18.0μm, and are slightly larger than spores reported from elsewhere. Crum & Anderson (1981) give a diameter range of 9-13μm while Lawton (1971) gives 9-14μm. This increase in spore size contrasts with capsule length measurements: 1.5-1.6mm in the Alaskan specimens and 2-3mm elsewhere (Crum & Anderson 1981; Ireland 1982; Lawton 1971). Seta length is also shorter: 5-6mm in the Alaskan specimens and ranges of 7-12mm (Crum & Anderson 1981), 10-15mm (Ireland 1982), and 10mm (Lawton 1971).

Distribution of the species:

In North America the species has been reported from British Columbia, Washington, Oregon, Idaho, Montana, South Dakota, Minnesota, Iowa, Nebraska, Mississippi, Louisiana, Tennessee, Virginia and north to Maine, Nova Scotia, Newfoundland, New Brunswick, Quebec, Ontario and Manitoba (Crum & Anderson 1981; Ireland 1982; Ireland et al. 1980; Lawton 1971). The species is also known from Japan, Siberia, the Caucasus, and northern and central Europe (Crum & Anderson 1981; Noguchi 1991). Ireland (1982) also included Africa in the world distribution.

We consider the finding of this species in far north-west Arctic Alaska, some hundreds of kilometres from the nearest North American occurrence, may result more from a lack of collections from this large and logistically challenging area than being a biogeographic anomaly. It is perhaps surprising, however, that the species has so far not been reported from south-eastern Alaska.

Acknowledgements: We are indebted to Prof. Wilf Schofield for confirming the identity of the species and to Carolyn Parker for access to an unpublished manuscript on the geomorphology and vegetation of the Kobuk Dunes. We also gratefully acknowledge research support provided by the National Park Service (NPS) to Prof. Gary Laursen, University of Alaska Fairbanks (UAF) Institute of Arctic Biology (IAB), and the USGS-BRD Alaska Fisheries Cooperative Fish and Wildlife Research Unit (ACFWRU), under research work orders (RWO98-61, RWO98-76) and research grants PX9830-92-385, PX9830-93-062, PX9830-0-451, PX9830-0-472, and PX9830-0-512. Valuable logistical support was also provided by the NPS through its Nome and Kotzebue offices.

Specimens examined:

Seppelt 22245, 22246, 22251, 12.viii.2000. On silt, litter and bark at base of *Salix alaxensis* stems in *Salix* thickets. Near edge of Kavet Creek. 67°07.724'N, 159°02.163'W. [Duplicate specimens have been lodged in herbaria of the Australian Antarctic Division (ADT), University of Alaska Museum, Fairbanks (ALA), and University of British Columbia (UBC)].

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Lichens Found on the 25th A. L. Andrews Foray in Northwestern Vermont

James W. Hinds[1], Elisabeth Lay[2] and Douglas Greene[2]

Abstract. *A total of 164 species of lichens were found in northwestern VT on the 25th Andrew Foray, including 32 species newly reported for VT and 4 newly reported for New England.*

The 25th A. Leroy Andrews Foray took place on Saturday, September 16 and Sunday, September 17, 2000, in northwestern Vermont, with participants staying at the Schenectady Wintersports Club Lodge in Waterbury Center. For Saturday's field trips participants split up into two groups: a northern group that included Douglas Greene, and a southern group that included James Hinds and Elisabeth Lay. The northern group visited the University of Vermont Research Forest, Jericho, Chittendon Co. (**J**) at an elevation of 170 feet and at 44°27' 05''N and 72°59'38''W; Waterbury Reservoir, Washington Co. (**WR**) at elevation 190 feet and at 44°22'54''N and 72°46'17"W; and the Little River State Park, Washington Co. (**LR**) at elevation 200 feet and at 44°23'24"N and 72°45'51"W. The southern group visited an old-growth forest stand at Lincoln Gap, Addison Co. (**LG**) at an elevation of 2424 feet and at 44°05'42"N and 72° 55'46"W; Marble Cliffs and Quarry, Middlebury, Addison Co. (**MCQ**) at an elevation of 350 feet and at 44°04'07"N and 73°08'18"W; and the Bristol cold air talus slope, Bristol, Addison Co. (**B**) at an elevation of about 1000 feet and at 44°06'19"N and 73°04'34"W. On Sunday, September 17, 2000, there was a trip that included Lay and Greene to Mt. Mansfield, Stowe, Lamoille Co. (**Mt.M**) at elevation 3850 feet and at 44°31'40"N and 72°48'54"W. All cited specimens are in the authors' personal herbaria. Species marked as new reports for VT or New England are based on the authors' unpublished lists of species previously reported for VT or New England.

Vermont is perhaps the least studied for lichens of the 6 NE states, so this foray was helpful in determining the lichens that occur in Vermont, with many new state records, even among the better studied macrolichens. Also interesting is what was *not* found. There were no pendant *Usnea* and only one tufted species, *U. subfloridana*, no pendant *Bryoria* species, no *Ramalina americana* specimens, and no *Nephroma* species. The absence of pendant *Usnea* and of *Ramalina americana*, which were common historically in VT and are common at similar latitudes in ME, seems particularly anomalous and may be the result of higher levels of pollutants, especially sulfur dioxide, in Vermont compared with parts of NE farther east (Ollinger et al. 1993).

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LIST OF SPECIES. (* New report for VT; ** New report for NE; n.s.(Hinds): no specimen, ID'd in field by Hinds; $\underline{R}_S$, siliceous rock, $\underline{R}_C$, calcareous rock, $\underline{R}$, rock, $\underline{T}$, bark of tree, $\underline{S}$, humus or soil)

Acarospora fuscata (Schrader) Arnold **B; Mt.M**: Lay 00-0075; -0076 $\underline{R}_S$, Greene 8|17-9-00 $\underline{R}$.
A. glaucocarpa (Ach.) Körber group **Mt.M**: Lay 00-0262 concrete.
* *A. sinopica* (Wahlenb.) Körber **WR**: Greene 14|16-9-00 $\underline{R}$.
Allocetraria oakesiana (Tuck.) Randlane & Thell **LG; B**: Hinds 4511 $\underline{T}$; 4526 $\underline{R}_S$.
Amandinea punctata (Hoffm.) Coppins & Scheid. **LG**: Lay 00-0077 $\underline{T}$.
Anaptychia palmulata (Michaux) Vainio **LG**: Lay 00-0078 $\underline{T}$.
Arctoparmelia centrifuga (L.) Hale **B; Mt.M**: n.s.(Hinds) $\underline{R}_S$; Lay 00-0079 $\underline{R}$.
* *Bacidia granosa* (Tuck.) Zahlbr. **MCQ**: Lay 00-0057 $\underline{R}_C$.
B. schweinitizii (Fr. *ex* E. Michener) A. Schneider **LG**: Lay 00-0080 $\underline{T}$.
Baeomyces rufus (Hudson) Rebent. **Mt.M**: Lay 00-0081 $\underline{R}$.
Biatora vernalis (L.) Fr. **LG**: Lay 00-0082 $\underline{T}$.
* *Bryophagus gloeocapsa* Nitschke *ex* Arnold **Mt.M**: Lay 00-0053 moss.
Bryoria nadvornikiana (Gyelnik) Brodo & D. Hawksw. **Mt.M**: Lay 00-0083 $\underline{T}$.
Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth. **MCQ**: Lay 00-0085 concrete.
Candelaria concolor (Dickson) Stein **LG; MCQ**: Lay 00-0087 $\underline{T}$; Hinds 4515 $\underline{T}$.
Cetraria laevigata Rass. **Mt.M**: Greene 25,26|17-9-00 $\underline{S}$, Lay 00-0088,89,90,91,92 $\underline{S}$.
Cetrelia olivetorum (Nyl.) Culb. & C. Culb. **J; B**: Greene 5,6|16-9-00 $\underline{T}$; Lay 00-0093 $\underline{R}$.
Chaenothecopsis debilis (Turner & Borrer *ex* Sm.) Tibell **MCQ**: Lay 00-0094 lignum.
C. mitis (Sandst.) Hustich **Mt.M**: Greene 12|17-9-00 $\underline{S}$.
C. rangiferina (L.) Nyl. **LR; B; Mt.M**: Lay 00-0096 $\underline{S}$; n.s.(Hinds) $\underline{S}$; Greene 12,40|17-9-00 $\underline{S}$.
C. stellaris (Opiz) Brodo **B**: Lay 00-0097 $\underline{S}$.
Cladonia amaurocraea (Flörke) Schaerer **B; Mt.M**: Hinds 4529 $\underline{R}_S$; Greene 14,21|17-9-00 $\underline{S}$.
C. caespiticia (Pers.) Flörke **LR; B**: Greene 24|16-9-00 $\underline{S}$; n.s.(Hinds) $\underline{S}$.
C. cervicornis (Ach.) Flotow **WR**: Greene 16|16-9-00 $\underline{S}$.
C. chlorophaea (Flörke *ex* Sommerf.) Sprengel group **LG; WR**: n.s.(Hinds) $\underline{S}$; Greene 20|16-9-00 $\underline{S}$.
C. coccifera (L.) Willd. **Mt.M**: Greene 3,10,13|17-9-00 $\underline{S}$.
C. cornuta (L.) Hoffm. **WR**: Greene 18|16-9-00 $\underline{S}$.
C. crispata (Ach.) Flotow **B**: Hinds 4531 $\underline{R}_S$.
C. cristatella Tuck. **LR**: Greene 25|6-9-00 $\underline{S}$.
C. deformis (L.) Hoffm. **WR**: Greene 17|16-9-00 $\underline{S}$.
C. furcata (Hudson) Schrader **B**: n.s.(Hinds) $\underline{S}$.
C. gracilis (L.) Willd. **Mt.M**: Greene 11|17-9-00 $\underline{S}$.
* *C. petrophila* R. C. Harris **B**: Lay 00-0059 $\underline{R}$.
C. pleurota (Flörke) Schaerer **B; Mt.M**: n.s.(Hinds) $\underline{S}$; Greene 22,26|17-9-00 $\underline{S}$.
C. rei Schaerer **J**: Greene 4|16-9-00 $\underline{S}$.
C. squamosa Hoffm. **B; Mt.M**: n.s.(Hinds); Greene 32|17-9-00 $\underline{S}$.
C. strepsilis (Ach.) Grognot **B**: Lay 00-0098 $\underline{S}$.
C. sulphurina (Michaux) Fr. **WR**: unknown collector, identified by Hinds.
C. turgida Hoffm. **B**: Lay 00-0100 $\underline{S}$, Hinds 4527 $\underline{S}$.
C. uncialis (L.) F. H. Wigg. **B**: n.s. (Hinds) $\underline{S}$.
Collema fuscovirens (With.) J. R. Laudon **MCQ**: Hinds 4518 $\underline{R}_C$.

C. subflaccidum Degel. **LG**: Lay 00-0099 T.
C. tenax (Sw.) Ach. **MCQ**: Lay 00-0064,69,101 S, Hinds 4521 S on R_C.
Dermatocarpon luridum (With.) J. R. Laundon **J**: Greene 1|16-9-00 R.
Dimelaena oreina (Ach.) Norman **B**: Lay 00-0102 R_S.
Evernia mesomorpha Nyl. **J; LR; LG**: Greene 10|16-9-00; 21|16-9-00 T; n.s.(Hinds) T.
* *Flavoparmelia baltimorensis* (Gyelnik & Fóriss) Hale **B**: Lay 00-0103 R_S.
F. caperata (L.) Hale **B**: n.s. (Hinds) R.
* *Fuscidea recensa* (Stirton) Hertel, V. Wirth & Vezda s.l. **B; Mt.M**: Lay 00-0070 R_S, 00-0071 T; 00-072 R_S.
** *F. subreagens* (H. Magn.) Oberholl. & V. Wirth **Mt.M**: Lay 00-0073,74 R_S.
Fuscopannaria leucophaea (Vahl) P. M. Jørg. **MCQ**: Hinds 4516 R_C.
Graphis scripta (L.) Ach. **LG**: Lay 00-0104 T, Hinds 4511 T.
* *Heterodermia speciosa* (Wulfen) Trevisan **B**: Hinds 4525 T.
Hypogymnia physodes (L.) Nyl. **MCQ; B; Mt.M**: n.s.(Hinds) T; Lay 00-0106; 00-0105 T, Greene 20|17-9-00 T.
Imshaugia aleurites (Ach.) S. F. Meyer **B**: n.s. (Hinds) T.
Lasallia papulosa (Ach.) Llano **B; Mt.M**: Lay 00-0108 R; 00-0109 R.
Lasallia pensylvanica (Hoffm.) Llano **B**: Lay 00-0115 R, Hinds 4528 R.
Lecanora glabrata (Ach.) Malme **LG**: Lay 00-0110 T.
L. hybocarpa (Tuck.) Brodo **LG**: Lay 00-0111 T.
L. intricata (Ach.) Ach. **Mt.M**: Greene 39|17-9-00 R, Lay 00-0112 R.
L. muralis (Schreber) Rabenh. **WR**: Greene 19|16-9-00 R.
L. polytropa (Hoffm.) Rabenh. **Mt.M**: Greene 7|17-9-00 R, Lay 00-0113 R.
L. pulicaris (Pers.) Ach. **Mt.M**: Lay 00-0116 T.
* *L. symmicta* (Ach.) Ach. **LR; LG; Mt.M**: Lay 00-0003; 00-0002; 00-0004 T, Greene 27|17-9-00 T.
L. thysanophora R. C. Harris **J; LG**: Greene 9|16-9-00 T; n.s.(Hinds) T.
* *Lecidea brunneofusca* H. Magn. **B**: Lay 00-0117 R_S.
Lempholemma polyanthes (Bernh.) Malme **MCQ**: Lay 00-0066,68 R_C.
Leptogium cyanescens (Rabenh.) Körber **J; LG**: Greene 3|16-9-00 T; Lay 00-0118 T, Hinds 4512 T.
L. dactylinum Tuck. **MCQ**: Lay 00-0063, 65, 67 R, Hinds 4522 R_C.
L. lichenoides (L.) Zahlbr. **MCQ**: Lay 00-0119,120,121 moss, Hinds 4519 moss on R_C.
Lobaria pulmonaria (L.) Hoffm. **LG**: n.s. (Hinds) T.
L. quercizans Michaux **LG**: Lay 00-0122 T.
* *Melanelia disjuncta* (Erichsen) Essl. **B**: Hinds 4532 R_S.
* *M. fuliginosa* (Fr. *ex* Duby) Essl. **LG**: Hinds 4511 T.
M. halei (Ahti) Essl. **LG**: Lay 00-0127, Hinds 4511 T.
M. hepatizon (Ach.) Thell **Mt.M**: Lay 00-0128 R.
M. panniformis (Nyl.) Essl. **B**: Lay 00-0123,129 R.
M. sorediata (Ach.) Goward & Ahti **B**: Hinds 4532 R_S.
M. subaurifera (Nyl.) Essl. **LG**: Lay 00-0130 T.
** *Micarea crassipes* (Th. Fr.) Coppins **Mt.M**: Lay 00-0056 moss.
* *M. erratica* (Körber) Hertel, Rambold, & Pietschmann **MCQ**: Lay 00-0131 R_S.
* *M. lignaria* (Ach.) Hedl. **Mt.M**: Lay 00-058 R_S, Greene 24|17-9-00 S.
* *M. melaena* (Nyl.) Hedl. **B**: Lay 00-0124, 125 moss.
* *M. peliocarpa* (Anzi) Coppins & R. Sant. **Mt.M**: Lay 00-0126 moss.
Mycoblastus sanguinarius (L.) Norman **B; Mt.M**: Lay 00-0135 R; 00-0136 R, -0137 T, -0138 T, Greene 36|17-9-00 S.
Myelochroa aurulenta (Tuck.) Elix & Hale **LG**: Lay 00-0139 T.

Myxobilimbia sabuletorum (Schreber) Hafellner **LG; MCQ; Mt.M**: Lay 00-0132 moss on T; 00-0133 moss on R; 00-0134 moss.
Ochrolechia frigida (Sw.) Lynge **Mt.M**: Lay 00-0140 moss.
O. trochophora (Vainio) Oshio **LG**: Lay 00-0143 T.
* *O. yasudae* Vainio **B**: Lay 00-0141 R.
Ophioparma ventosa (L.) Norman **Mt.M**: Greene 34|17-9-00 R, Lay 00-0142 R.
* *Parmelia neodiscordans* **B**: Hinds 4523 R.
P. omphalodes (L.) Ach. **B; Mt.M**: Lay 00-0145,146; 00-0144 R.
P. saxatilis (L.) Ach. **B; Mt.M**: Lay 00-0147 R; 00-0148 T, 00-0149 R.
P. squarrosa Hale **LG**: n.s. (Hinds) T.
P. sulcata Taylor **LG**: Hinds 4511 T.
Parmeliopsis ambigua (Wulfen) Nyl. **Mt.M**: Lay 00-0156 T.
P. capitata R. C. Harris **B**: n.s. (Hinds) T.
P. hyperopta (Ach.) Arnold **Mt.M**: Lay 00-0157 T.
Peltigera canina (L.) Willd. **MCQ**: Lay 00-0032 S.
P. evansiana Gyelnik **MCQ**: Hinds 4514 S.
P. polydactylon (Necker) Hoffm. **MCQ**: n.s. (Hinds) S.
P. praetextata (Flörke *ex* Sommerf.) Zopf **LG; MCQ; B**: Lay 00-028, 29, 30 R; 00-0033 R; 00-0034 R.
P. rufescens (Weiss) Humb. **LG; MCQ**: Lay 00-0031 S; n.s.(Hinds) S.
Pertusaria amara (Ach.) Nyl. **LG**: Lay 00-0150 T.
P. macounii (Lamb) Dibben **LG**: Lay 00-0151 T.
P. rubefacta Erichsen **LG**: Lay 00-0152 T.
Phaeocalicium curtisii (Tuck.) Tibell **MCQ**: Lay 00-0153 T.
Phaeophyscia adiastola (Essl.) Essl. **B; MCQ**: Hinds 4526 R; Lay 00-0154, Hinds 4513 R.
* *P. orbicularis* (Necker) Moberg **MCQ**: Hinds 4520 moss on R_C.
P. pusilloides (Zahlbr.) Essl **LG**: Hinds 4510 T.
P. rubropulchra (Degel.) Essl. **LG; MCQ**: n.s.(Hinds) T; Hinds 4515 T.
* *Phlyctis argena* (Sprengel) Flotow **LG**: Lay 00-0155 T.
Physcia aipolia (Ehrh. *ex* Humb.) Fürnr. **MCQ**: Hinds 4515 T.
P. caesia (Hoffm.) Fürnr. **WR**: unknown collector, identified by Hinds.
P. millegrana Degel. **MCQ**: Hinds 4515 T.
P. subtilis Degel. **B**: Hinds 4523 R_S.
Physconia detersa (Nyl.) Poelt **LG**: Hinds 4510 T.
Placynthium nigrum (Hudson) Gray **MCQ**: Lay 00-0158 R.
Platismatia glauca (L.) Culb. & C. Culb. **Mt.M**: Lay 00-0159 T.
Porpidia albocaerulescens (Wulfen) Hertel & Knoph **J; MCQ**: Greene 7|16-9-00 R; n.s.(Hinds) R.
* *P. cinereoatra* (Ach.) Hertel & Knoph **B; Mt.M**: Lay 00-0012 R_S; 00-0014,15 R_S.
P. crustulata (Ach.) Hertel & Knoph **Mt.M**: Lay 00-0009 R_S.
* *P. diversa* (Lowe) Gowan **Mt.M**: Lay 00-0007 R_S.
P. macrocarpa (DC.) Hertel & A. J. Schwab **Mt.M**: Lay 00-0010 R_S.
* *P. tuberculosa* (Sm.) Hertel & Knoph **Mt.M**: Lay 00-0011 R_S.
Protoblastenia rupestris (Scop.) J. Steiner **MCQ; Mt.M**: Lay 00-0161 R_C; 00-0160 concrete.
Pseudevernia cladonia (Tuck.) Hale & Culb. **Mt.M**: Lay 00-0162 T.
P. consocians (Vainio) Hale & Culb. **Mt.M**: Greene 37|17-9-00 T, Lay 00-0163 T.
Psilolechia lucida (Ach.) M. Choisy **B**: Lay 00-0095 R_S.
Punctelia rudecta (Ach.) Krog **LG**: n.s. (Hinds) T.
Pyxine sorediata (Ach.) Mont. **B**: Hinds 4524 T.

Ramalina farinacea (L.) Ach. **WR**: unknown collector, identified by Hinds

R. intermedia (Delise *ex* Nyl.) Nyl. **B; Mt.M**: Lay 00-0036 R; 00-0044 moss.

Rhizocarpon badioatrum (Flörke *ex* Sprengel) Th. Fr. **Mt.M**: Lay 00-0061 R_S, Greene 5,38|17-9-00 R.

* *R. cinereovirens* (Müll. Arg.) Vainio **Mt.M**: Lay 00-0060 R_S.

R. geographicum (L.) DC **Mt.M**: Greene 3|17-9-00 R.

* *R. obscuratum* (Ach.) A. Massal. **Mt.M**: Greene 6|17-9-00 R.

** *R. polycarpum* (Hepp) Th. Fr. (odd I- medulla per A. Fryday) **Mt.M**: Lay 00-0062 R_S.

Rhizoplaca subdiscrepans (Nyl.) R. Sant. s. lat. **B**: Lay 00-0165 R, Hinds 4533 R_S.

* *Rinodina bischoffii* (Hepp) A. Massal. **MCQ**: Lay 00-0049 R_C.

Rinodina subminuta H. Magn. **LG**: Lay 00-0023 T.

Sarcogyne privigna (Ach.) A. Massal. **B**: Lay 00-0166 R.

S. regularis Körber **MCQ**: Lay 00-0167 R_C.

* *Scoliciosporum umbrinum* (Ach.) Arnold **B**: Lay 00-0170 R.

Sphinctrina turbinata (Pers.: Fr.) de Not. **LG**: Lay 00-0170 on *Pertusaria macounii* on T.

Stereocaulon dactylophyllum Flörke **WR**: Greene 15|16-9-00 R.

S. glaucescens Tuck. **WR; B**: Greene 11|16-9-00 S; Hinds 4530 R_S.

* *S. grande* (H. Magn.) H. Magn. **Mt.M**: Greene 23|17-9-00 S.

S. pileatum Ach. **LR**: Lay 00-0173 R.

S. saxatile H. Magn. **WR; B; Mt.M**: Greene 12|16-9-00 R; n.s.(Hinds) R_S; Lay 00-0171,172 R.

** *Thelocarpon impressellum* Nyl. (unusual greenish ascomata) **Mt.M**: Lay 00-0054 moss.

* *Trapelia placodioides* Coppins & P. James **MCQ**: Lay 00-0175 R_S.

Trapeliopsis granulosa (Hoffm.) Lumbsch **Mt.M**: Greene 9|17-9-00 S, Lay 00-0174 S.

Tuckermannopsis americana (Sprengel) Hale **LR**: Greene 22|16-9-00 T.

T. sepincola (Ehrh.) Hale **Mt.M**: Greene 2,19|17-9-00 T, Lay 00-0176 T.

Umbilicaria deusta (L.) Baumg. **Mt.M**: Greene 35|17-9-00 R, Lay 00-0177 R.

U. mammulata (Ach.) Tuck. **B**: n.s. (Hinds) R.

U. muehlenbergii (Ach.) Tuck. **B**: Lay 00-0422 R.

Usnea subfloridana Stirton **LR; Mt.M**: Greene 20|16-9-00 T; Lay 00-0178 T.

Vulpicida pinastri (Scop.) J.-E. Mattsson & M. J. Lai **B; Mt.M**: n.s.(Hinds) T; Greene 1,30|17-9-00 T, Lay 00-0179 T.

Xanthoparmelia conspersa (Ehrh. *ex* Ach.) Hale **B**: n.s. (Hinds) R_S.

Xanthoria elegans (Link) Th. Fr. **WR**: unknown collector, identified by Hinds.

X. fallax (Hepp) Arnold **MCQ**: Lay 00-0180 T.

Acknowledgments. The authors are grateful to the many specialists that confirmed or corrected our identifications, including Dick Harris, Jutta Buschbom, Alan Fryday, Scott LaGreca, Steve Selva, Bernard Goffinet, John Sheard, and Stephen Clayden.

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Heterodermia sitchensis found in Oregon, U.S.A.

Gayle McHenry[1] and Tor Tønsberg[2]

Abstract. Heterodermia sitchensis *is reported new to U.S.A. from coastal Oregon, where it is corticolous or muscicolous on* Picea sitchensis *twigs also supporting, e.g.,* Heterodermia japonica, H. leucomela, *and* Teloschistes flavicans.

Heterodermia sitchensis Goward & Noble is a rare species previously reported from two sites on the west coast of Vancouver Island, British Columbia, Canada (Goward 1984). Being rare, and also threatened by logging and the collecting of firewood, it is considered "endangered" in Canada (Goward et al. 1998). Recently (summer of 2001), Goward found more sites for it on Vancouver Island (pers. comm. to T. Tønsberg). Goward (1984) expected the species to occur also in other humid parts of the Pacific Coast. In 2000 and 2001, *Heterodermia sitchensis*, as well as another rare species, *H. japonica* (Sato) Swinscow & Krog, were found on Cape Lookout, on the Oregon coast of U.S.A.; these finds are commented on below. The genus *Heterodermia* was recently treated for the Sonoran Desert area by Moberg & Nash III (1999).

Cape Lookout is a narrow peninsula jutting more than 2 km out into the Pacific Ocean. It supports an old-growth, coastal temperate rain forest of the seasonal rain forest type (see Alaback and Pojar 1997, and Schoonmaker et al. 1997: plate 2). It is accessible via a path on or near the wind-exposed crest above a steep cliff. The cliff forms the south side of the peninsula, and ranges in elevation from more than 200 m near the parking lot to about sea-level near the tip. Along the path are giant specimens of *Picea sitchensis* and *Tsuga heterophylla* supporting a luxurious epiphytic flora of bryophytes and lichens.

Heterodermia sitchensis was collected from fallen mossy twigs of *Picea sitchensis* along parts of the path winding in the north-facing slope just beneath the ridgetop. The fallen twigs, apparently windfall, were rich in oceanic and/or hypermaritime lichen species. Noteworthy species included *Cavernularia hultenii, Gyalideopsis anastomosans, Heterodermia japonica, H. leucomela, Hypotrachyna revoluta, Parmotrema crinitum, Pertusaria glaucomela, Ramalina roesleri, Teloschistes flavicans*, and *Usnea rubicunda.* The north-facing, foreshore situation seems to indicate a requirement for high humidity as suggested by Goward (1984), and the occurrence on windfall suggests that it is able to grow on twigs/branches subjected to strong winds. *Heterodermia sitchensis* is new to U.S.A.

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Heterodermia japonica was found on the same *Picea twigs* that supported *H. sitchensis*. The ecorticate lower surface sometimes had minute orange spots reacting purplish with K. According to Bruce McCune (pers. comm. 2001), *H. japonica* has only once before been found in Oregon (from near Reedsport, Douglas Co. (OSC)).

In an interesting paper on the biogeography of rare lichens on the coast of Oregon, McCune et al. (1997) present locality types with unusual concentrations of rare species. One such type is "major headlands and capes" and the species listed for this type are *Heterodermia leucomela* and *Teloschistes flavicans*. *Heterodermia sitchensis* and *H. japonica* can now be added to this list.

Specimens examined:

Heterodermia sitchensis: U.S.A. Oregon, Tillamook Co., Oregon coast, Cape Lookout, along Cape Lookout Trail, (GPS at start of trail:) 45°20'37"N, 124°00'W, elev. 100-200 m, 11 Sept. 2000, *McHenry 091100.10* (WTU); 45°20.4'N, 123°59.5'W, elev. 150-160 m, 10 June 2001, *Tønsberg 30434* (BG); 45°20.3'N, 123°59.6'W, elev. 180-190 m, 10 June 2001, *Tønsberg 30437* (BG).

Heterodermia japonica: U.S.A. Oregon, Tillamook Co., Oregon coast, Cape Lookout, along Cape Lookout Trail, (GPS at start of trail:) 45°20'37"N, 124°00'W, elev. 100-200 m, 11 Sept. 2000, *McHenry 091100.09a* (WTU; conf. R. Moberg 2002), *091100.09b* (WTU; det. R. Moberg 2002); 45°20.4'N, 123°59.5'W, alt. 150-160 m, 10 June 2001, *Tønsberg 30432* (BG; det. R. Moberg 2001), *30433* (BG; conf. R. Moberg 2001).

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Arsène historical collection from New Mexico

Tom Nash

An important Arsène historical collection from New Mexico was re-discovered recently by Dave Johnson at the College of Santa Fe in 1999. During an ABLS (American Bryological & Lichenological Society) field trip around Santa Fe in 2001, participants were invited to inspect the collections. It was evident that these were authentic collections made by Frère G. Arsène Brouard from the Christian Brotherhood in and around Santa Fe in the 1930s. Brother Arsène sent most of his lichen collections to Maurice Bouly de Lesdain, and many new taxa originally described by Bouly de Lesdain from New Mexico were based on his material. Bouly de Lesdain retained specimens sent to him in his private herbarium in Dunkerque , France, and sent back to Brother Arsène letters detailing his determinations. Brother Arsène maintained a detailed catalog of these determinations, a vital document also discovered by Dave Johnson. Unfortunately, Bouly de Lesdain's collections were destroyed in World War II, and much of the important "type" material of these new taxa was lost.

Many specimens of these re-discovered collections were mentioned in the second major paper on New Mexico lichens by Bouly de Lesdain (1942), and some may represent isotypes or isosyntypes that may be suitable for selection as lectotypes.
Bouly de Lesdain, M. (1942): Lichens de l'État de New-Mexico (U.S.A.) recueillis par le Frère G. Arsène Brouard (supplément). Revue Bryologique et Lichénologique 12: 44-66.

Most of these specimens are from the later period in Brother Arsène's life. Based on specimen collection dates, they do not represent duplicates of collections upon which Bouly de Lesdain based his first New Mexico lichen paper in 1932:
Bouly de Lesdain, M. (1932): Lichens de l'État de New-Mexico (U.S.A.) recueillis par le Frère G. Arsène. Annales de Cryptogamie Exotique 5: 89-139.

The historical Frère Arsène Brouard lichen collection was kindly donated to ASU by the Christian Brothers of the College of Santa Fe, New Mexico, in 2002. According to our agreement duplicates of the original collections will also be deposited in Santa Fe and OMA (University of Nebraska at Omaha).

Specimens from the collection have been curated with the help of Robert S. Egan, Dave Johnson, Thomas H. Nash III, Bruce Ryan and F. Bungartz. Robert S. Egan (OMA) and Dave Johnson (Santa Fe) have catalogued the collection and Corinna Gries imported the data into the ASU database and are available at http://ces.asu.edu/ASUlichens/index.html.

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Bryophytes of the Interior Highlands of North America: New Missouri and Illinois County Records

Carl E. Darigo[1]

This paper reports on 89 new bryophyte, Missouri and Illinois county records in the Interior Highlands of North America.

The Interior Highlands of North America is divided into several topographic regions, which include the southern portion of Missouri, much of Arkansas, a small section of southern Illinois, and extends along the eastern border of Oklahoma.

New moss county records for the Interior Highlands are distributed as follows:
MISSOURI--63 new county records

Border Counties (5): St. Charles-2, Warren-3
Mississippi Lowlands (3): New Madrid-3
St. Francois Mountains (17): Iron-9, Madison-4, Reynolds-4
Salem Plateau (33): Bollinger-8, Cooper-2, Dent-6, Gasconade-1, Phelps-1, St. Francois-4, St. Louis-4, Texas-1, Washington-6
Springfield Plateau (5): Lawrence-1, McDonald-2, Newton-2
ILLINOIS--1 new county record
Ozark Hills (1): Pope-1

New liverwort county records for the Interior Highlands are distributed as follows: MISSOURI--25 new county records
St. Francois Mountains (12): Iron-8, Madison-1, Reynolds-3
Salem Plateau (12): Dent-1, Franklin-1, Gasconade-2, Jefferson-1, St. Francois-3, St. Louis-1, Texas-1, Washington-2
Springfield Plateau (1): McDonald-1

The mosses reported in this paper were verified by Bruce Allen, and liverworts either by Bruce Allen, the author, or Steve Timme. The basis for establishing new Interior Highlands moss county records is Redfearn (2001), the liverwort records from Timme & Redfearn (1997) and Gier (1955). All collections are deposited at MO. Missouri county records are indicated by county name only, while the Illinois record is identified by county and state abbreviation.

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MOSSES

AMBLYSTEGIACEAE

Campylium hispidulum (Brid.) Mitt. **Madison**: Rock Creek, Mark Twain National Forest, Darigo 3710.

C. radicale (P. Beauv.) Grout **Bollinger**: Castor River Conservation Area, Brant 4706. This species is known from only one other report in the Interior Highlands and Missouri, and is listed as SU (status undetermined) in Missouri's "Species of Conservation Concern Checklist" (2001)

C. stellatum (Hedw.) C. Jens. var. ***stellatum*** **Dent**: Little Creek, Mark Twain National Forest, Brant & Loges 5122. This species is known from only one other report in the Interior Highlands and Missouri, and is listed as SU (status undetermined) in MSCCC (2001).

Cratoneuron filicinum (Hedw.) Spruce **Dent**: Little Creek, Mark Twain National Forest, Brant 4879. **Iron**: Wolf Pen Hollow, Mark Twain National Forest, Brant 4973.

Hygroamblystegium tenax (Hedw.) Jenn. var. ***tenax*** **Texas**: Dripping Springs Natural Area, Smith et al. 3748.

Leptodictyum humile (P. Beauv.) Ochyra **Dent**: Little Creek, Mark Twain National Forest, Brant 5007. **Warren**: Harmony Church, Darigo 3720.

L. riparium (Hedw.) Warnst.-***laxirete expression*** **Iron**: Cedar Creek, Mark Twain National Forest, Brant 4889. **Washington**: Cub Creek, Mark Twain National Forest, Brant & O'Donnell 4952. This taxon typically occurs submerged in flowing water; the leaves are often erect, and radially arranged on the stems. The plants macroscopically closely resemble *Fontinalis* Hedw.

AULACOMNIACEAE

Aulacomnium palustre (Hedw.) Schwaegr. **Newton**: Diamond Grove Prairie Conservation Area, Darigo 3737. **St. Francois**: S-F Scout Ranch, Solomon 21311. **Washington**: east of Hwy P, Mark Twain National Forest, Brant 5187.

BRACHYTHECIACEAE

Brachythecium rivulare Schimp. *in* B.S.G. **Bollinger**: Castor River, Brant 5233. **Gasconade**: Mint Spring Conservation Area, Holmberg 54. **Iron**: Clayton Creek, Mark Twain National Forest, Brant 4958.

B. rutabulum (Hedw.) Schimp. *in* B.S.G. **Iron**: Jones Creek, Mark Twain National Forest, Brant 4917.

B. salebrosum (Web. & Mohr) var. ***salebrosum*** **Reynolds**: Bee Fork, Mark Twain National Forest, Brant 4870A. **Washington**: Trace Creek, Mark Twain National Forest, Allen 23958.

Eurhynchium hians (Hedw.) Sande Lac. **Bollinger**: Castor River, Brant & O'Donnell 4896. **Reynolds**: Fishtrap Hollow, Mark Twain National Forest, Brant & O'Donnell 4970. **Warren**: Harmony Church, Darigo 3719.

BRYACEAE

Bryum dichotomum Hedw. **Bollinger**: Castor River, Brant & O'Donnell 4895.

Pohlia wahlenbergii (Web. & Mohr) Andrews **Madison**: Silver Mines, Mark Twain National Forest, Sullivan & P. Harris sn.

Rhodobryum ontariense (Kindb.) Par. *in* Kindb. **Iron**: Ottery Creek, Mark Twain National Forest, Brant & O'Donnell 4925A.

CLIMACIACEAE

Climacium americanum Brid. **Newton**: Diamond Grove Prairie Conservation Area, Harris & Harris 30.

DITRICHACEAE

Ditrichum pusillum (Hedw.) Hampe **St. Louis**: Clayton, Nelson 790. This specimen, which was collected in 1905, was found in the Clyde Reed herbarium, recently acquired by MO.

FISSIDENTACEAE

Fissidens adianthoides Hedw. **Bollinger**: Castor River, Brant 5232. **Iron**: Jones Creek, Mark Twain National Forest, Brant 4919. **Warren**: Kullman property, Clauson & Darigo 2.

F. grandifrons Brid. **Phelps**: Meramec Spring Park, Solomon 21299.

FONTINALACEAE

Fontinalis sphagnifolia (C. Müll.) Wijk. & Marg. **Dent**: Dead Horse Hollow, Mark Twain National Forest, Brant & O'Donnell 4962. **Reynolds**: Henry Branch, Mark Twain National Forest, Brant 5066. **St. Francois**: S-F Scout Ranch, Solomon 21318. **Washington**: Clear Creek, Mark Twain National Forest, Brant & O'Donnell 4866. Although this species was listed as S1 (critically iimperiled) in MSCCC (2001), its rating has been changed due to the recent numerous findings.of the species. Allen (pers. com.) considers *F. sphagnifolia* to be perhaps the most common *Fontinalis* species in the Interior Highlands

FUNARIACEAE

Funaria flavicans Michx. **St. Charles**: Katy Trail State Park, Darigo & Clark 3716.

GRIMMIACEAE

Grimmia pilifera P. Beauv. **St. Louis**: Maritz Corp., Fenton, Solomon 21337.

HELODIACEAE

Helodium paludosum (Sull.) Aust. **Dent**: Rd 2223, Mark Twain National Forest, Brant & O'Donnell 4967. This species has been reported only five other times in Missouri, and is listed as S1 (critically imperiled) in MSCCC (2001).

HYPNACEAE

Isopterygium tenerum (Sw.) Mitt. **Iron**: James Creek, Mark Twain National Forest, Brant 5169. **Washington**: east of Hwy P, Mark Twain National Forest, Brant 5186.

LESKEACEAE

Haplocladium microphyllum (Hedw.) Broth. **McDonald**: Big Sugar Creek State Park, Holmberg & Darigo 47.

ORTHOTRICHACEAE

Orthotrichum ohioense Sull. & Lesq. *in* Aust. **Bollinger**: Castor River, Brant 4961A. **Madison**: Rock Creek, Mark Twain National Forest, Darigo 3711.

O. strangulatum P. Beauv. **New Madrid**: New Madrid Historical Museum, Darigo & Drey 3814.

POLYTRICHACEAE

Atrichum altecristatum (Ren. & Card.) Smyth & Smyth **St. Charles**: Busch Conservation Area, Darigo & Darigo 3703. **St. Louis**: Beaumont Scout Reservation, Solomon 21302.

Pogonatum brachyphyllum (Michx.) P. Beauv. **Bollinger**: Castor River, Brant & O'Donnell 4897

P. pensilvanicum (Hedw.) P. Beauv. **Cooper**: Pleasant Grove, Bush sn. This specimen, collected in 1899, was found in the Clyde Reed herbarium.

POTTIACEAE

Barbula unguiculata Hedw. **Pope IL**: Hwy 146, west of Golconda, Darigo & Darigo 3781.

Gymnostomum aeruginosum Sm. **Iron**: Ottery Creek, Mark Twain National Forest, Brant & O'Donnell 4924.

Hymenostylium recurvirostre (Hedw.) Dix. **Reynolds**: Camden Hollow, Mark Twain National Forest, Brant & O'Donnell 5106. **St. Francois**: St. Francois State Park, Darigo 3714.

Syntrichia pagorum (Milde) Amann. **New Madrid**: New Madrid Historical Museum, Darigo & Drey 3808.

Tortula obtusifolia (Schwaegr.) Math. **New Madrid**: New Madrid Historical Museum, Darigo & Drey 3809.

Weissia controversa Hedw. **Lawrence**: Woods Prairie, Holmberg 25.

SEMATOPHYLLACEAE

Sematophyllum demissum (Wils.) Mitt. **St. Francois**: S-F Scout Ranch, Solomon 21320.

SPHAGNUM

Sphagnum centrale C. Jens *in* Arnell & C. Jens. **Washington**: Clear Creek, Mark Twain National Forest, Brant & O'Donnell 4867. This species has been reported only once previously in the Interior Highlands and Missouri; and is rated S1S2 (imperiled to critically imperiled) in MSCCC (2001).

S. lescurii Sull. *in* Gray **Bollinger**: Castor River, Brant 4197. **Cooper**: Pleasant Grove, Bush sn. This specimen, collected in 1899, was found in the Clyde Reed herbarium. **Dent**: Coalpit Hollow Branch, Mark Twain National Forest, Brant 4878.

TETRAPHIDACEAE

Tetraphis pellucida Hedw. **St. Francois**: S-F Scout Ranch, Solomon 21331.

THELIACEAE

Thelia asprella Sull. *in* Sull. & Lesq. **Bollinger**: Castor River, Brant 5222.

THUIDIACEAE

Cyrto-hypnum minutulum (Hedw.) Buck & Crum **Iron**: Clayton Creek, Mark Twain National Forest, Brant 5030.

Thuidium delicatulum (Hedw.) Schimp. *in* B.S.G. **McDonald**: Big Sugar Creek State Park, Darigo 3725.

LIVERWORTS

ANEURACEAE

Aneura pinguis (L.) Dum. **Iron**: Council Bluff Lake, Mark Twain National Forest, Brant 4907. This species is ranked SU (status undetermined) in MSCCC (2001).

CALYPOGEIACEAE

Calypogeia fissa (L.) Raddi ssp. ***neogaea*** Schust. **Dent**: Dead Horse Hollow, Mark Twain National Forest, Brant & O'Donnell 4965. **Iron**: Panther Branch, Mark Twain National Forest, Brant 5199.

CONOCEPHALACEAE

Conocephalum conicum (L.) Lindb. **Gasconade**: Mint Spring Conservation Area, Holmberg 52. **Iron**: Big River, Mark Twain National Forest, Brant & O'Donnell 4935. **Reynolds**: Bee Fork, Mark Twain National Forest, Brant & O'Donnell 4869A.

GYMNOMITRIACEAE

Marsupella sphacelata (Gieseke) Dum. **St. Francois**: S-F Scout Ranch, Solomon 21324. This species is listed as S1 (critically imperiled) in MSCCC (2001).

JUBULACEAE

Frullania eboracensis Gott. **Jefferson**: Surdyke property near Festus, Darigo 3806.

JUNGERMANNIACEAE

Jamesoniella autmnalis (DC.) Steph. var. ***autumnalis*** **Washington**: Clear Creek, Mark Twain National Forest, Brant 5151.

LOPHOCOLEACEAE

Chiloscyphus bidentata (L.) Eng. & Schuster **Iron**: Henderson Creek, Mark Twain National Forest, Brant 4989.

C. pallescens (Ehrh. *ex* Hoffm.) Dum. var. ***pallescens*** **Reynolds**: Little Brushy Creek, Mark Twain National Forest, Brant & O'Donnell 5075.

MARCHANTIACEAE

Marchantia polymorpha L. **Texas**: Dripping Springs Natural Area, Smith et al. 3747.

Preissia quadrata (Scop.) Nees **Iron**: tributary of Middle Fork, Black River, Mark Twain National Forest, Brant 5237. This uncommon species is listed as S? (not ranked as yet) in MSCCC (2001).

PELLIACEAE

Pellia epiphylla (L.) Corda **Gasconade**: Mint Spring Conservation Area, Holmberg 53. **St. Francois**: S-F Scout Ranch, Solomon 21323.

PORELLACEAE

Porella pinnata L. **Iron**: Cub Creek, Mark Twain National Forest, Brant 4875. **St. Francois**: S-F Scout Ranch, Solomon 21322. **Washington**: Trace Creek, Mark Twain National Forest, Brant 5091.

P. platyphylla (L.) Pfeiff. **Iron**: Jones Creek, Mark Twain National Forest, Brant 4920. **St. Louis**: Cliff Cave Park, Holmberg 22.

P. platyphylloidea (Schwein.) Lindb. **Madison**: Rock Creek, Mark Twain National Forest, Darigo 3712.

PTILIDIACEAE

Trichocolea tomentella (Ehrh.) Dum. **Iron**: Ottery Creek, Mark Twain National Forest, Brant & O'Donnell 4925. **Reynolds**: Bee Fork, Mark Twain National Forest, Brant & O'Donnell 4869.

RADULACEAE

Radula complanata (L.) Dum. **McDonald**: Huckleberry Ridge Conservation Area, Holmberg & Darigo 49.

RICCIACEAE

Ricciocarpos natans (L.) Corda **Franklin**: Washington Riverfront Trail, Holmberg 27.

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